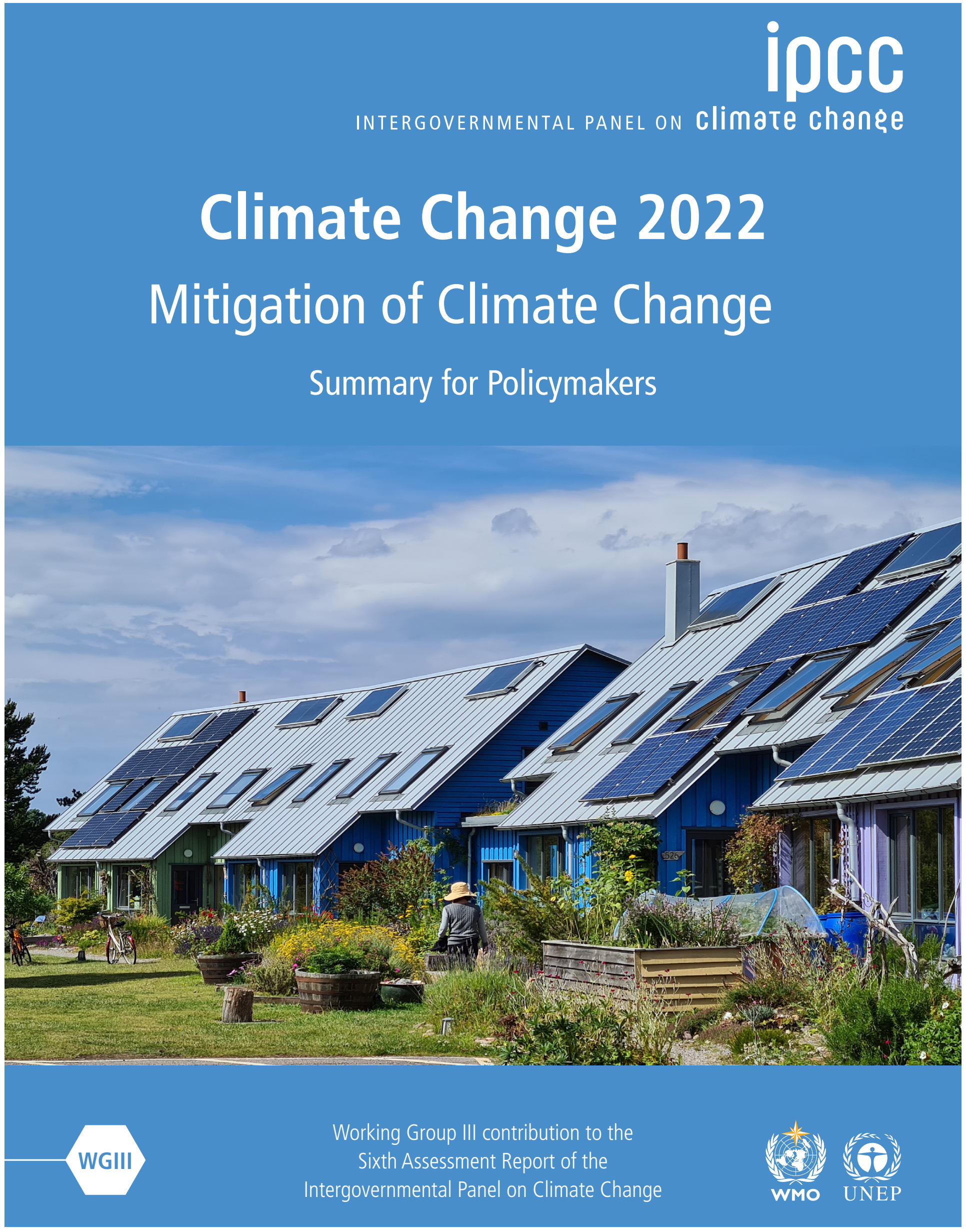
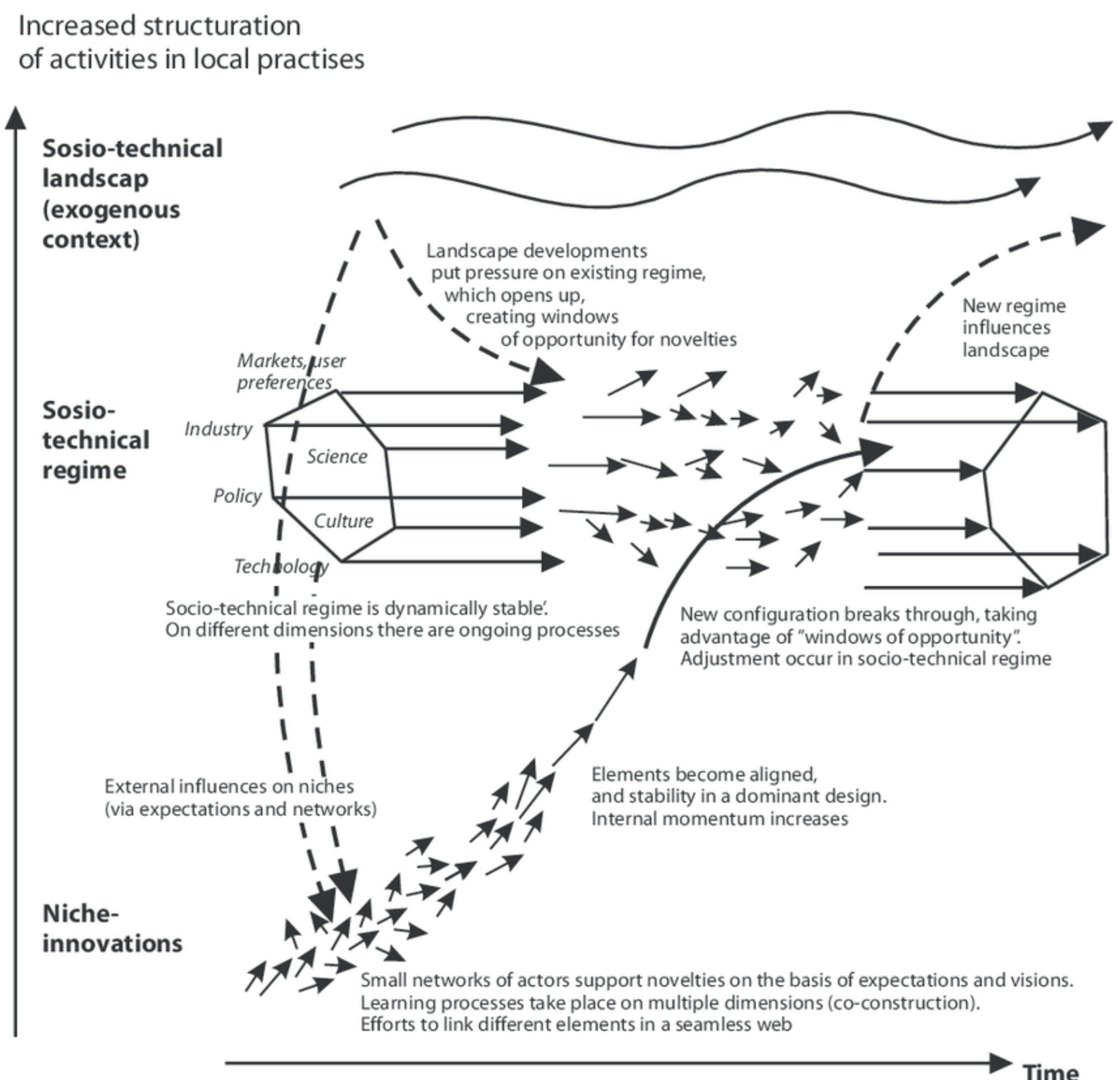


- 2900 pages
- Transition : 2517 fois
- Transitions : 1890 fois
- Sufficiency : 188 fois
- Degrowth : 26 fois et 4 fois dans le corps du texte.
- 3131 scénarios, « scenarios that include economic degrowth are not fully represented, as these scenarios, were not submitted to the database »



Source: Geels and Schot (2007, p. 401)

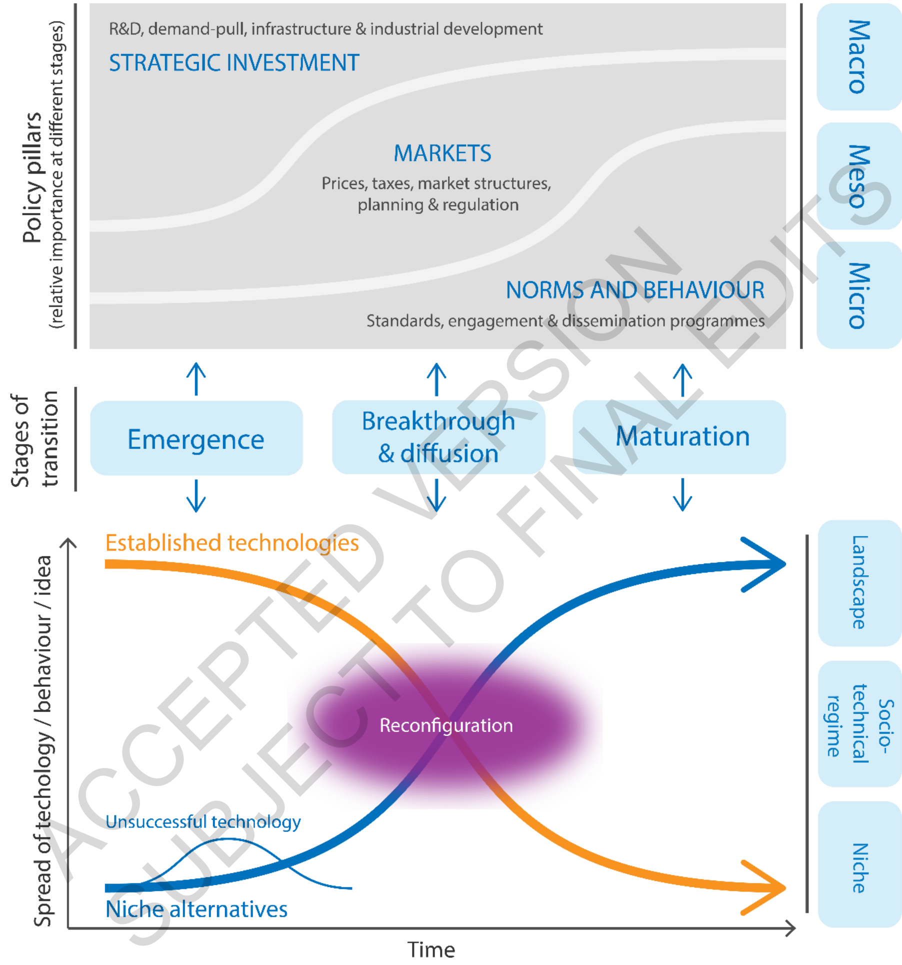
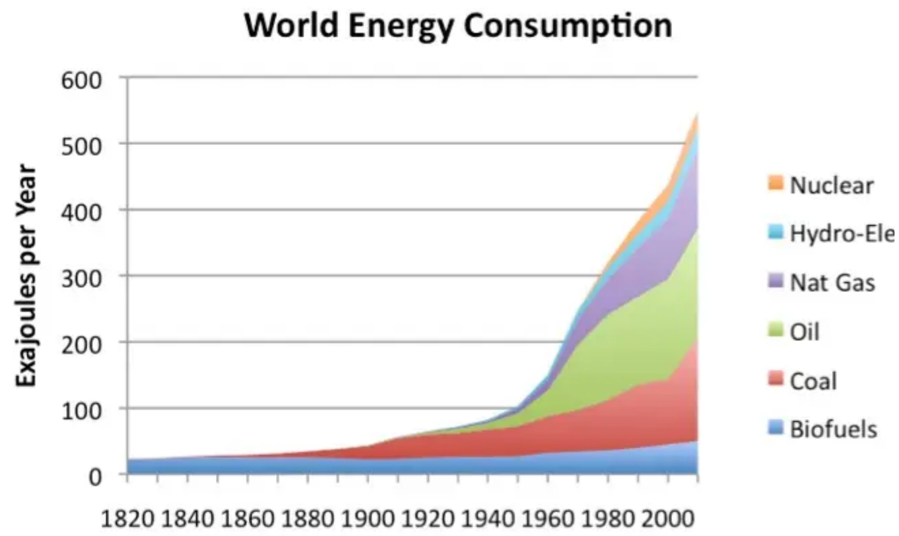


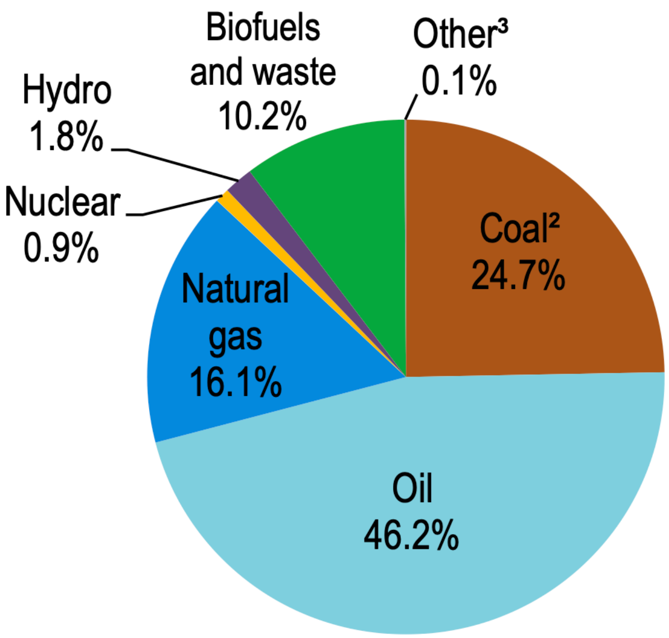
Figure 1.6: Transition dynamics: levels, policies and processes

« Energy transitions can occur faster than in the past »

« A Low-Carbon Energy Transition Needs to Occur Faster Than Previous Transitions » p. 369

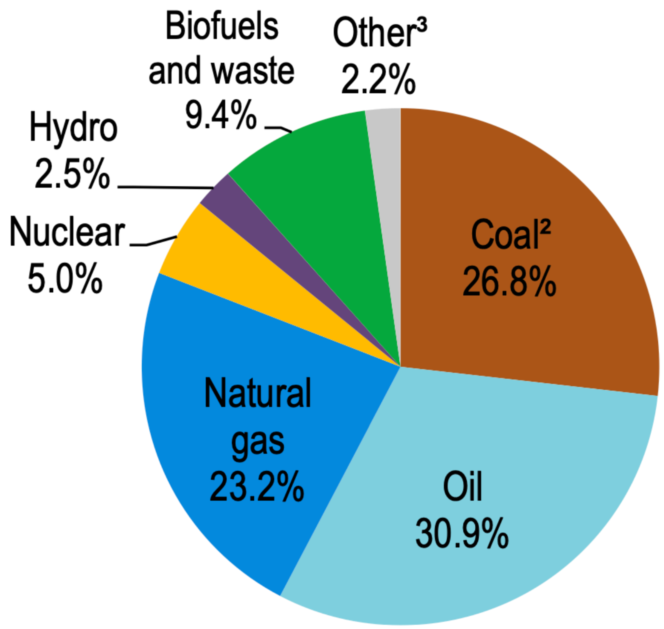


1973



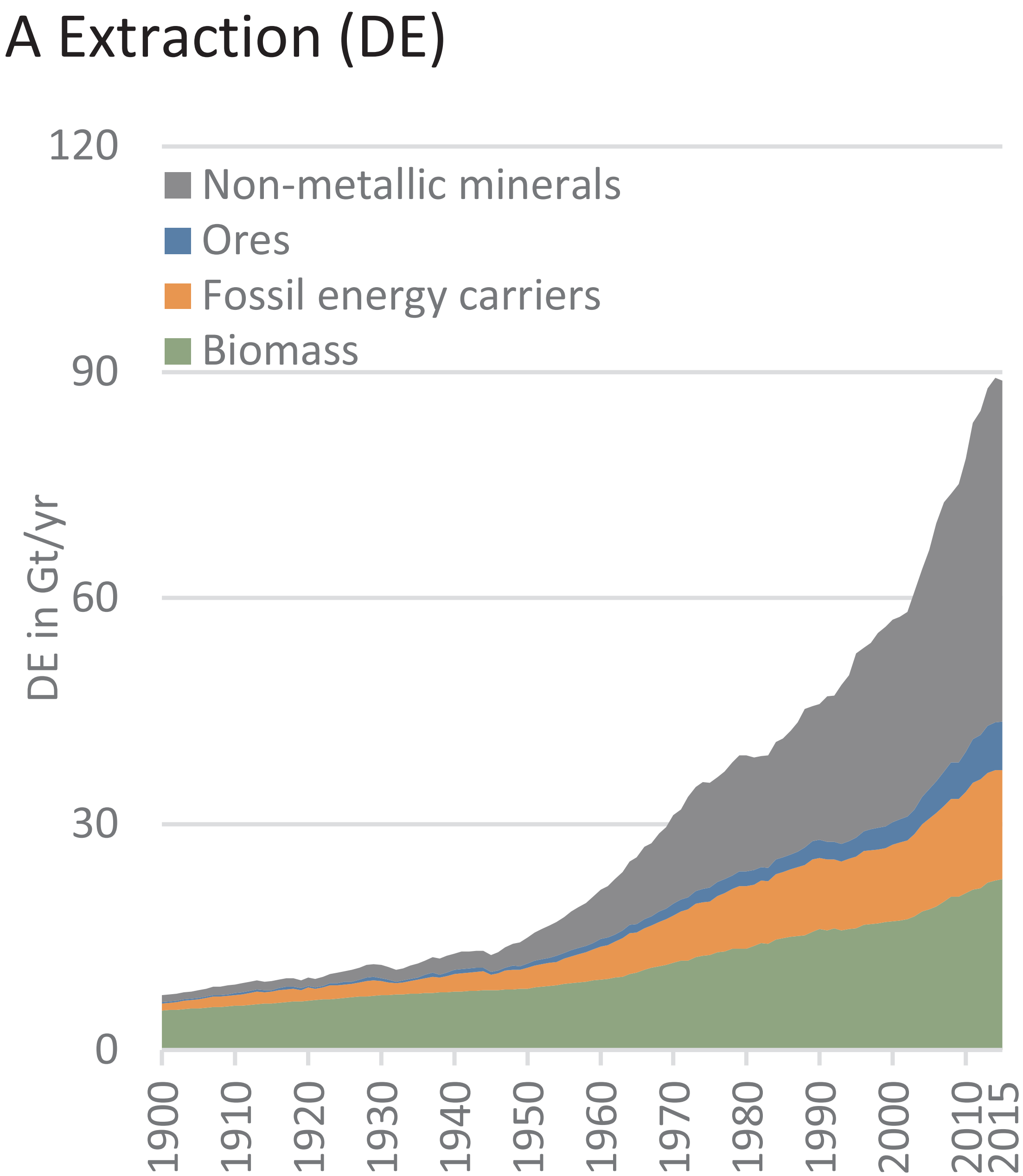
254 EJ

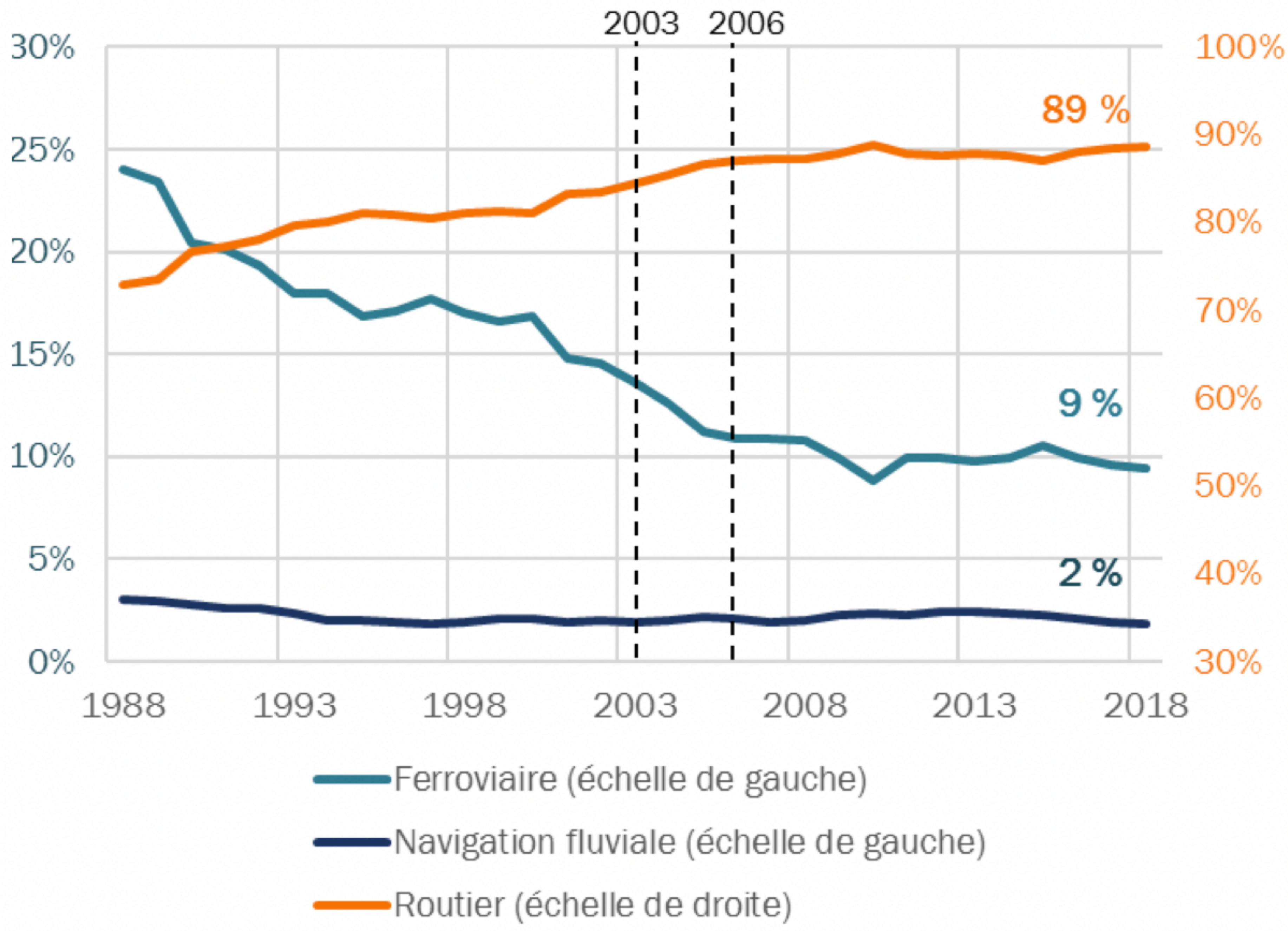
2019



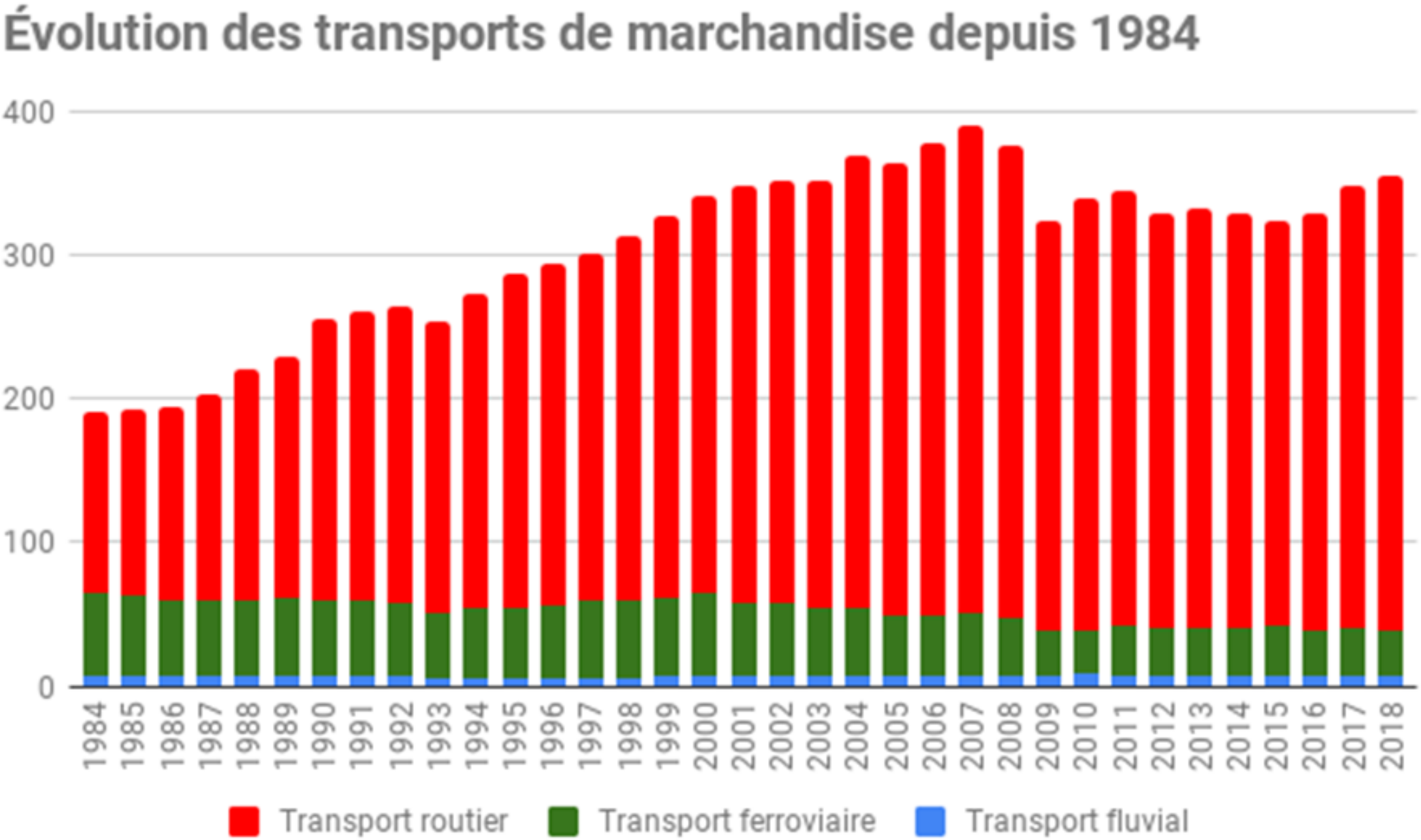
606 EJ

Histoire des techniques ≠ histoire de la matière

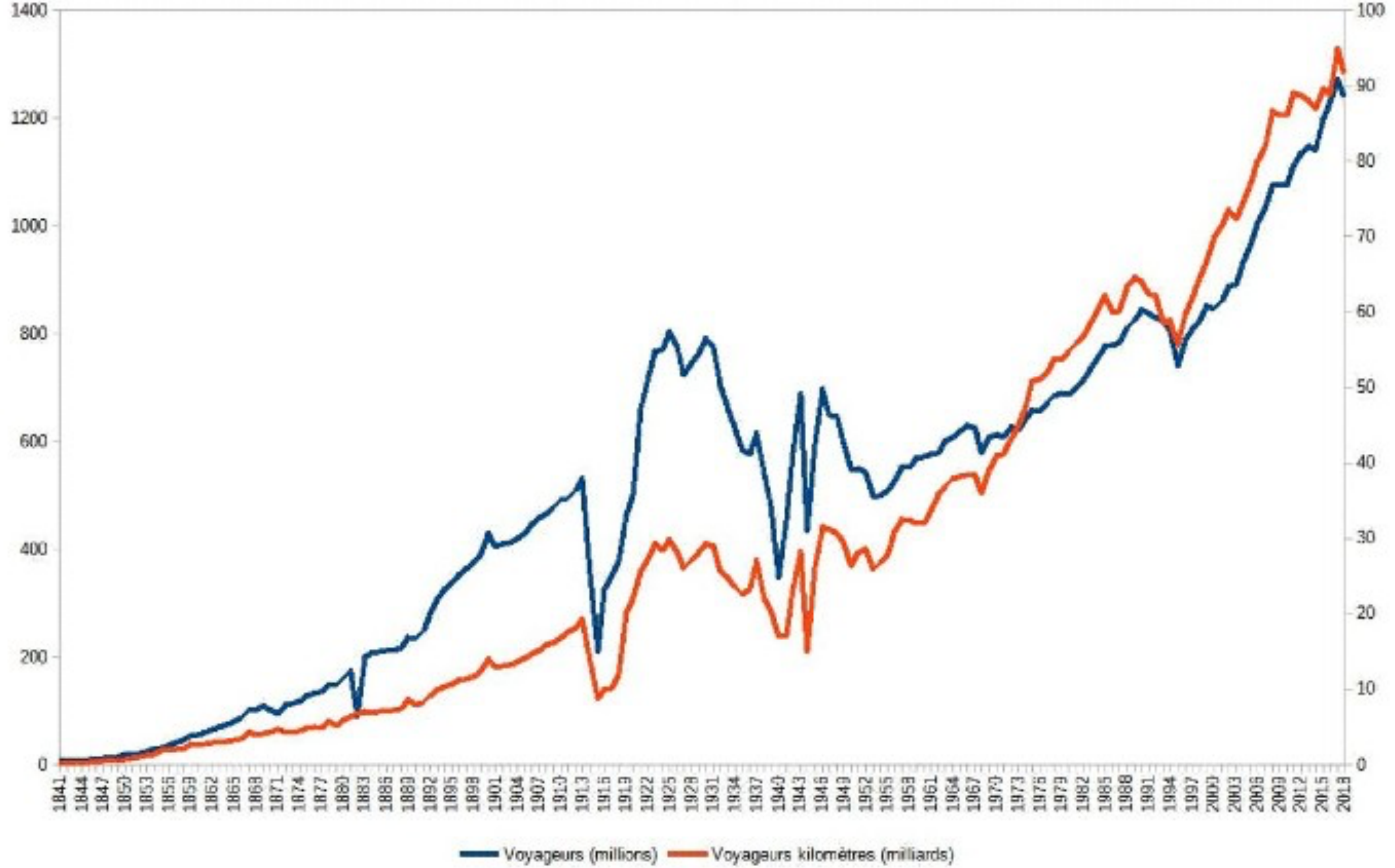




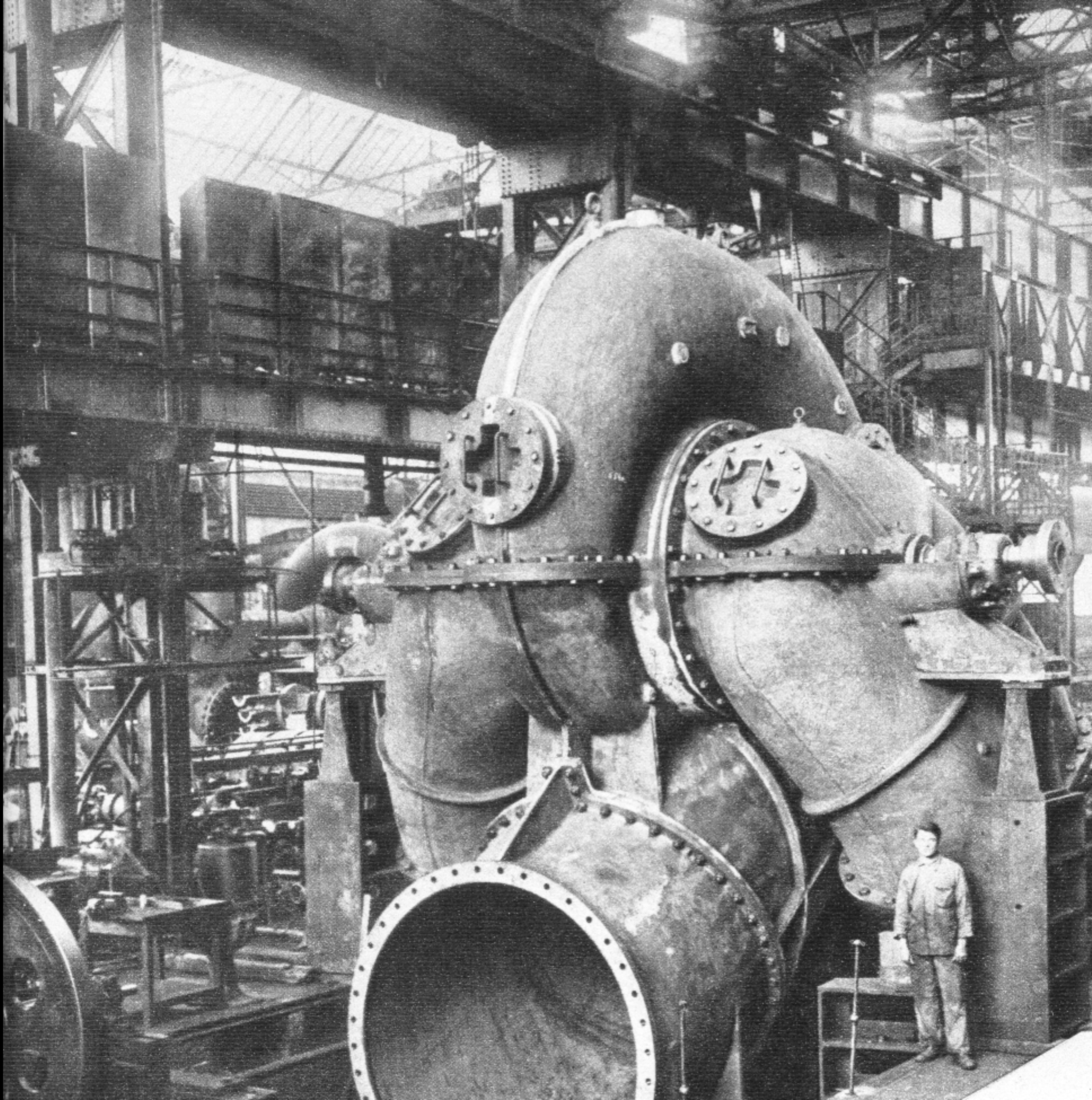
2003
2006
30%
25%
20%
15%
10%
5%
0%
100%
90%
80%
70%
60%
50%
40%
30%
89 %
9 %
2 %
1988
1993
1998
2003
2008
2013
2018
Ferroviaire (échelle de gauche)
Navigation fluviale (échelle de gauche)
Routier (échelle de droite)

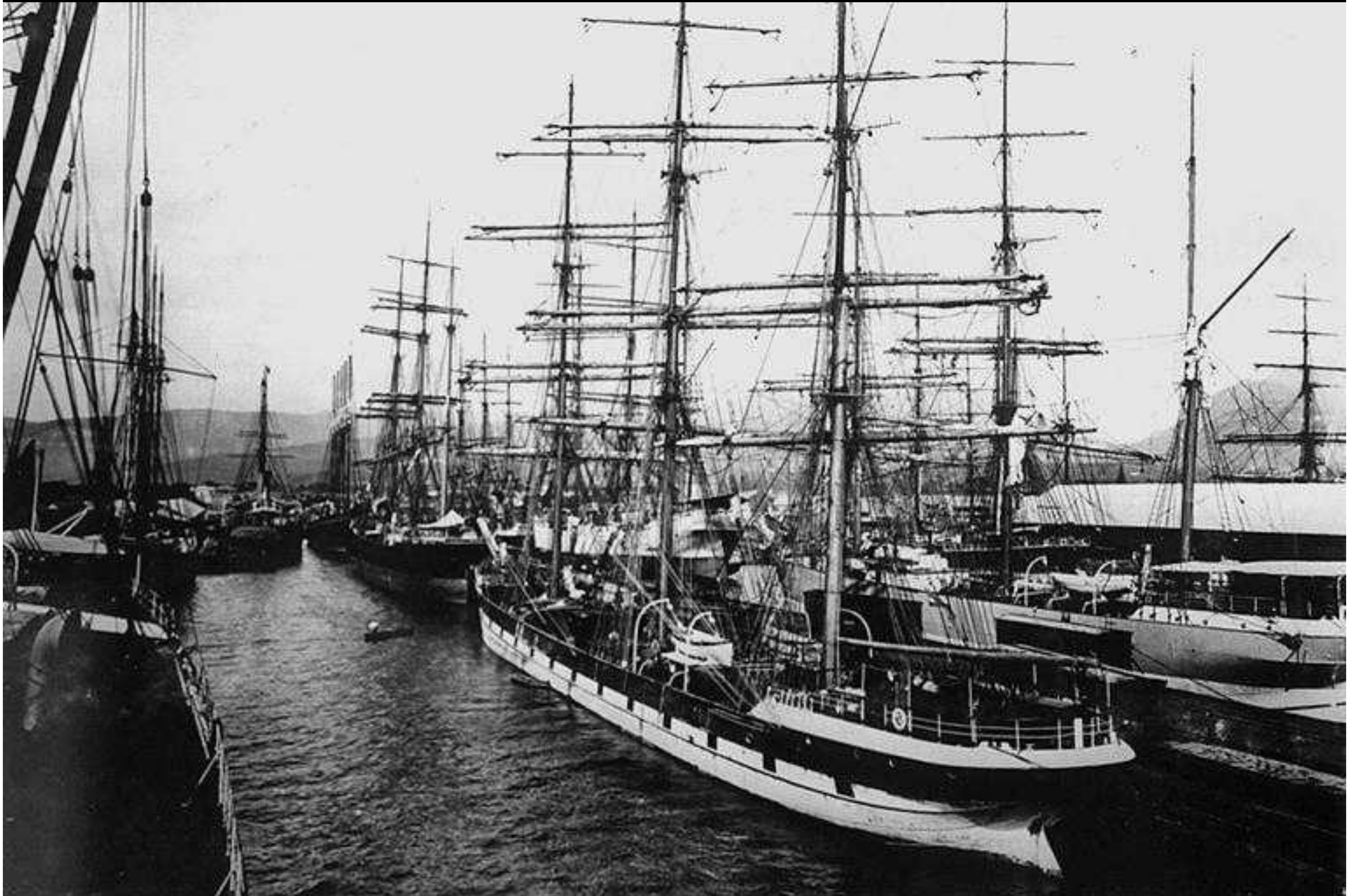


Volume en milliard de tonne-kilomètre à partir de 1984, INSEE

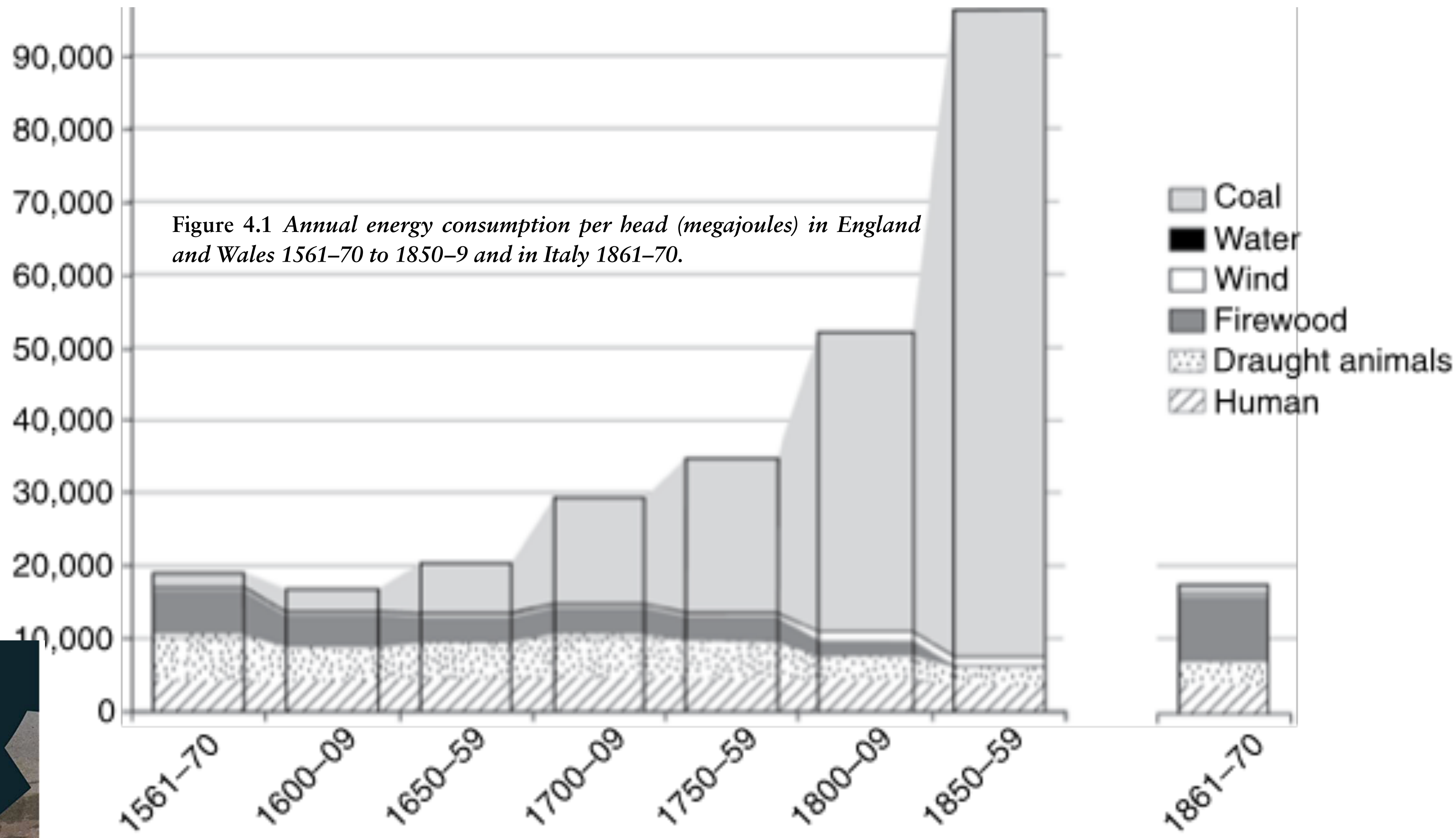

1400
1200
1000
800
600
400
200
0
100
90
80
70
60
50
40
30
20
10
0
1841 1844 1847 1850 1853 1856 1859 1862 1865 1868 1871 1874 1877 1880 1883 1886 1889 1892 1895 1898 1901 1904 1907 1910 1913 1916 1919 1922 1925 1928 1931 1934 1937 1940 1943 1946 1949 1952 1955 1958 1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991 1994 1997 2000 2003 2006 2009 2012 2015 2018
Voyageurs (millions)
Voyageurs kilomètres (milliards)

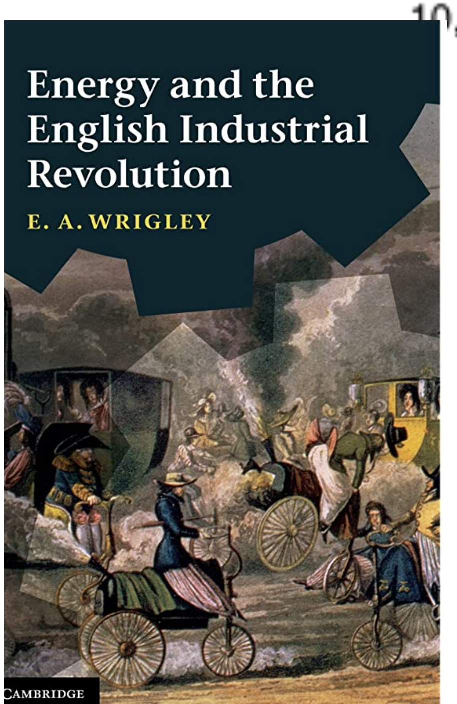
Additions énergétiques





Symbioses énergétiques





Anthony Wrigley *Energy and the Industrial Revolution*
(based on the data collected by Paul Warde)

Figure 3. Déchargement de bois de mine à West Hartlepool, au sud de Newcastle. T.W. Birch, « The Afforestation of Britain », *Economic Geography* , 1936, Vol. 12, n°1, p. 1-26

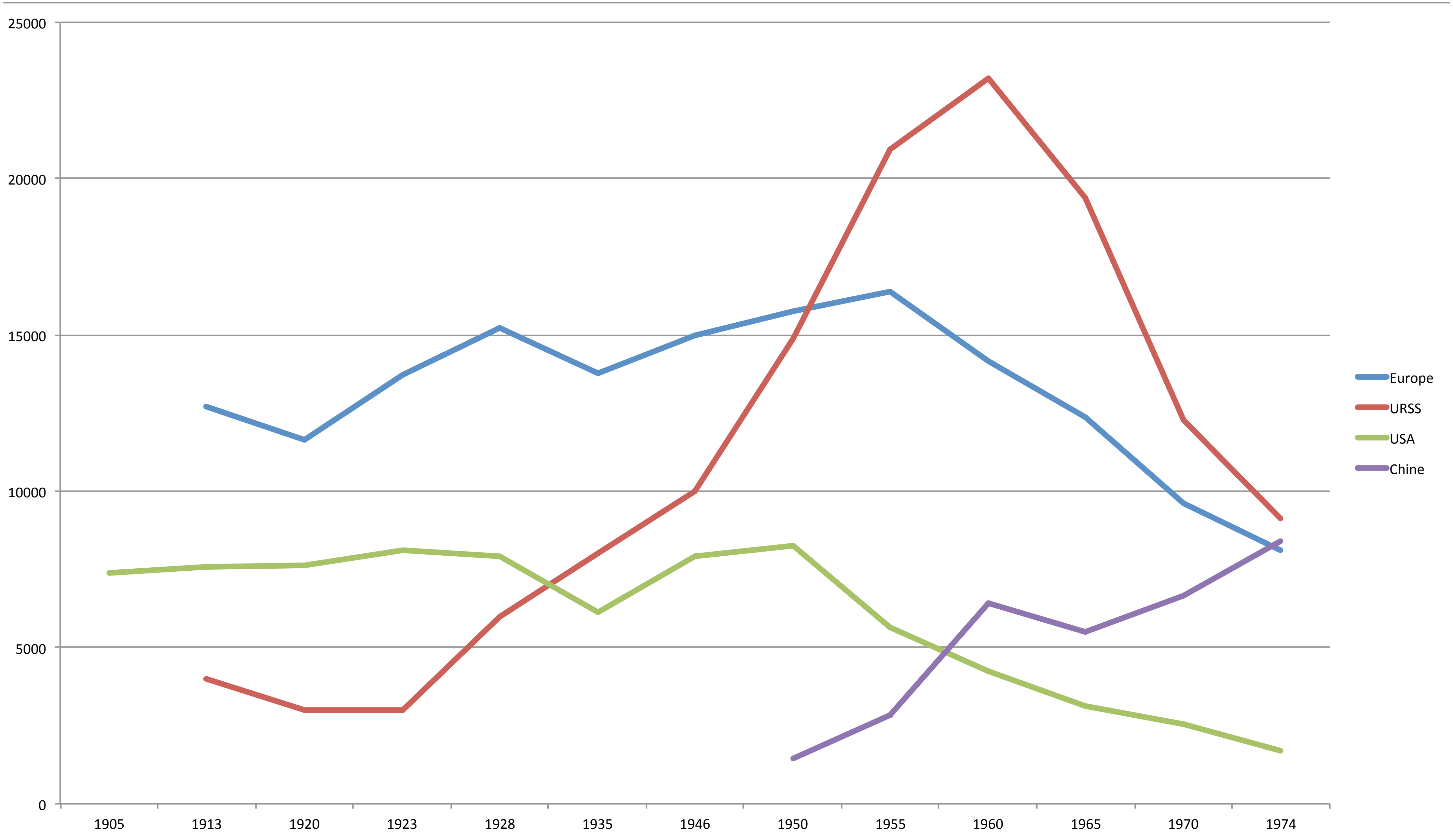
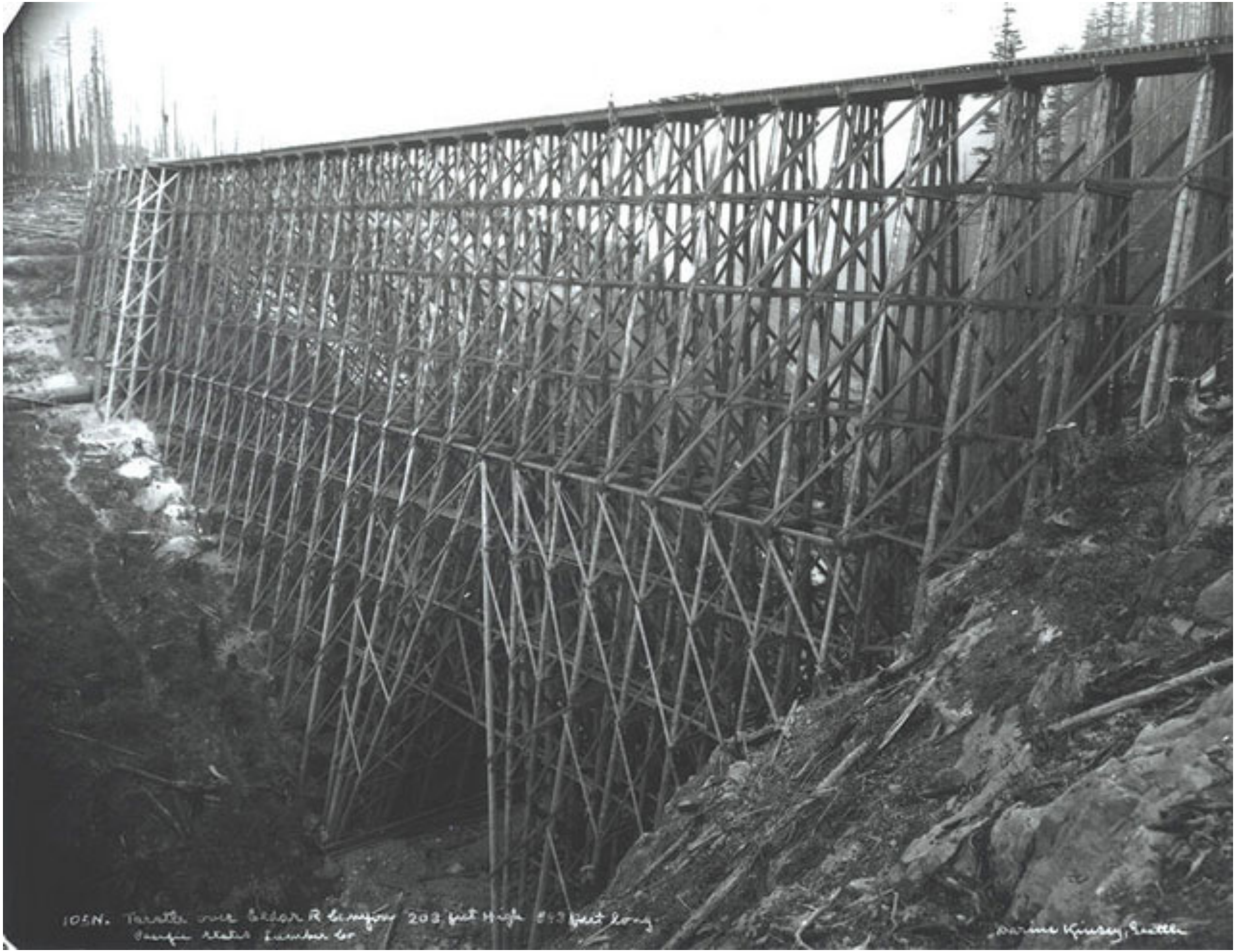
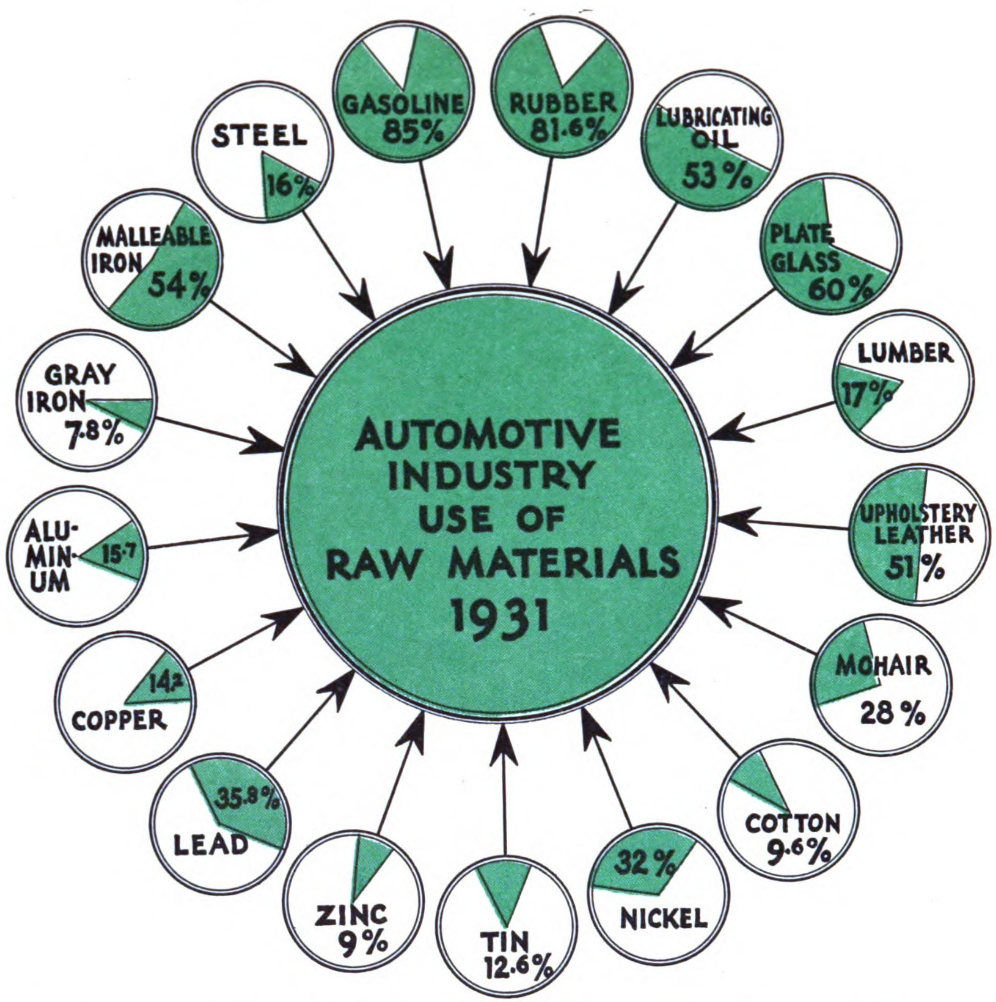


Figure 1. Consommation de bois de mines en milliers de mètres-cubes.
Sources : FAO, *European Timber Statistics*, 1913-1950, Genève 1953 ; FAO, Forest Products Statistics, Part II Apparent Consumption, 1950-1975, Rome, 1975 ; J.J. MacGregor, « Timber Statistics », *Journal of the Royal Statistical Society,* vol. 116, n°3, 1953, p. 298-322 ; Forest Service, US Department of Agriculture, *Timber Resources for America's Future*, 1958 ; Robert Stone, « Wood products used by coal mines », *Forest Products Journal*, vol. 35, n°6, p. 45-52 ; Richardson, *Forestry in Communist China*, Baltimore, Johns Hopkins, 1966 p. 164.


105N. Trestle over Cedar R Canyon 203 feet High 843 feet long
Pacific States Lumber Co
Darius Kinsey, Seattle



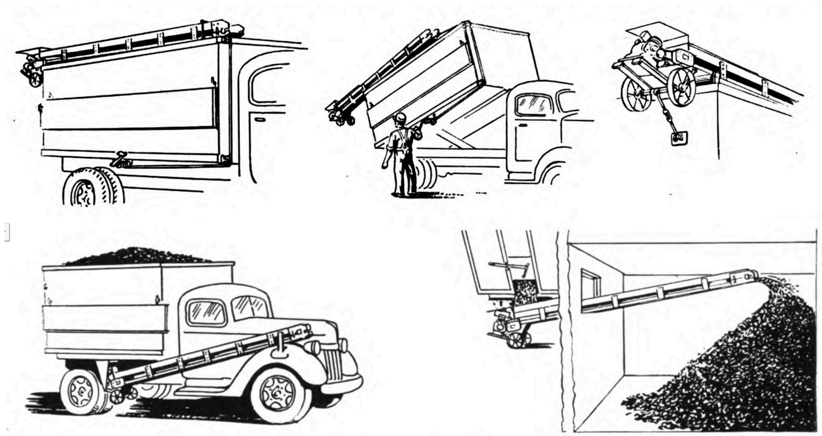
Additional Raw Materials Used in Motor Industry

No attempt has been made to estimate quantities used of each material

Sulphuric Acid	Soda ash	Platinum	Soap	Machine Tools	Asbestos
Hydrochloric Acid	Caustic soda	Gold	Celluloid	Coal Coke	Carborundum
Alkali	Turpentine	Silver	Chamois	Gas	Emery
Carbon Black	White lead	Mercury	Polish	Fuel oil	Garnet
Acetylene	Formaldehyde	Radium	Paper	Electricity	Silicon
Butanol	Phenol	Tungsten	Cork	Wool	Onyx
Cellulose Acetate	Arsenic	Phosphorus	Charcoal	Silk	Agate
Sulphur	Litharge	Molybdenum	Flaxseed	Hemp	Talc
Carbon	Cadmium	Magnesium	Linseed Oil	Jute	Silica sand
Nitro-cellulose	Alcohol	Vanadium	Animal Fat	Canvas	Limestone
Pyroxylin	Glycerine	Bismuth	Corn	Felt	Salt
Resin	Glue	Porcelain	Sugar cane	Moss	Tanning mat'ls
Shellac	Rope	Mica	Borax	Curled hair	Dyes

Automotive freight represented 1 out of every 8 carloads of traffic originated on railroads in 1931.

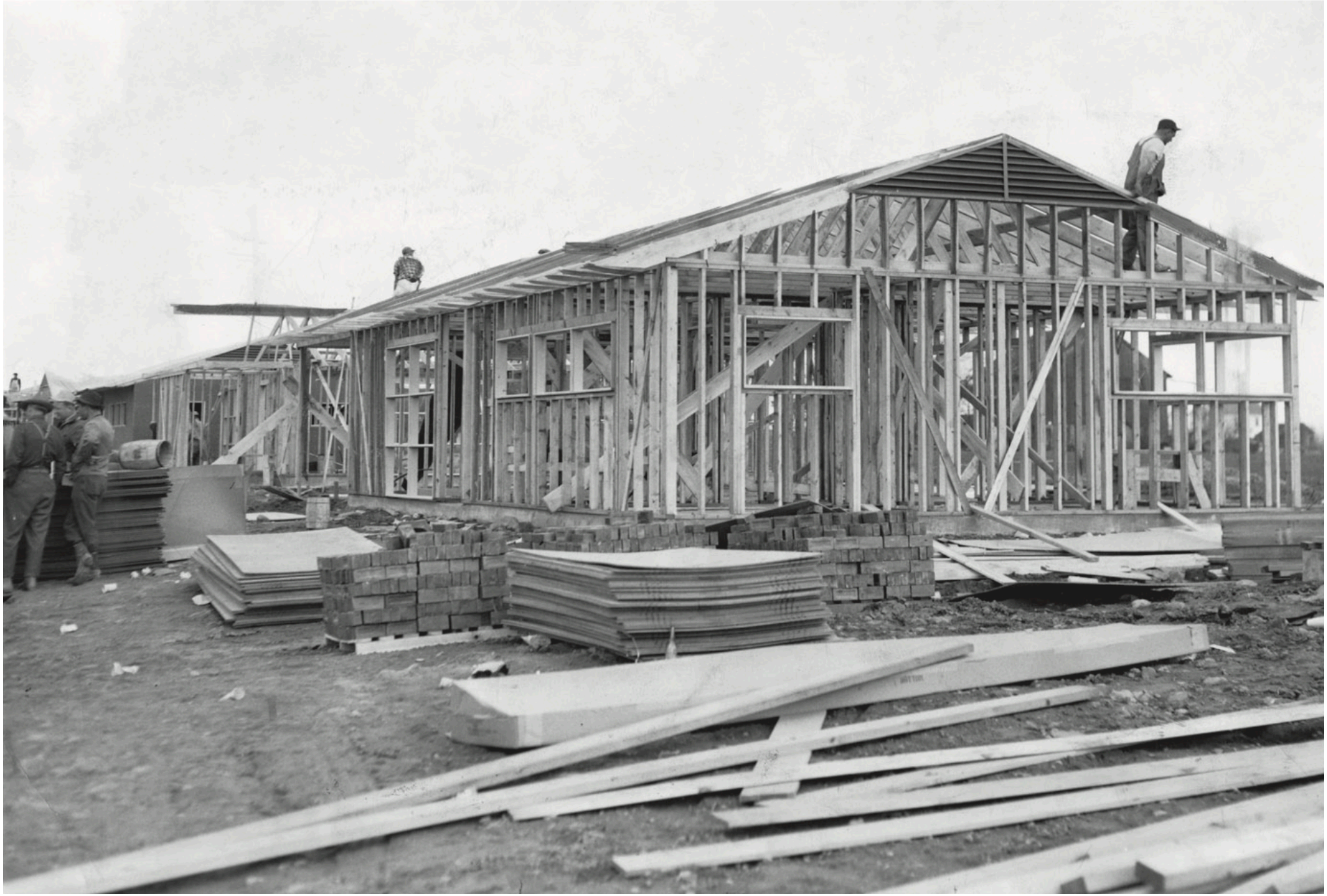
Matériaux utilisés par l'industrie Automobile	**% du total de la consommation aux USA**	**Utilisation maximale de ressources nationales**
	Période 1921-1939	
Fer et Acier	15.86%	25.35% en 1935
Aluminium	22.35%	46.5% en 1925
Cuivre	14%	20,28% en 1935
Etain	14.5%	24,8% en 1928
Plomb	24.57%	38.8% en 1934
Hardwood	13.7%	32.6% en 1938
Caoutchouc	80.5%	84.7% en 1926
	Période 1955-1962	
Fer et Acier (1955-1962)	19.5%	21% en 1960
Cuivre (1956-1962)	5.9%	7% en 1956
Plomb (1956-1962)	46%	49.2% en 1962
Caoutchouc (1956-1962)	61.7%	62.4% en 1960
Autres ressources		
Wagons de marchandises	13.59%	15.4% en 1935
Essence	90%	96% en 1924

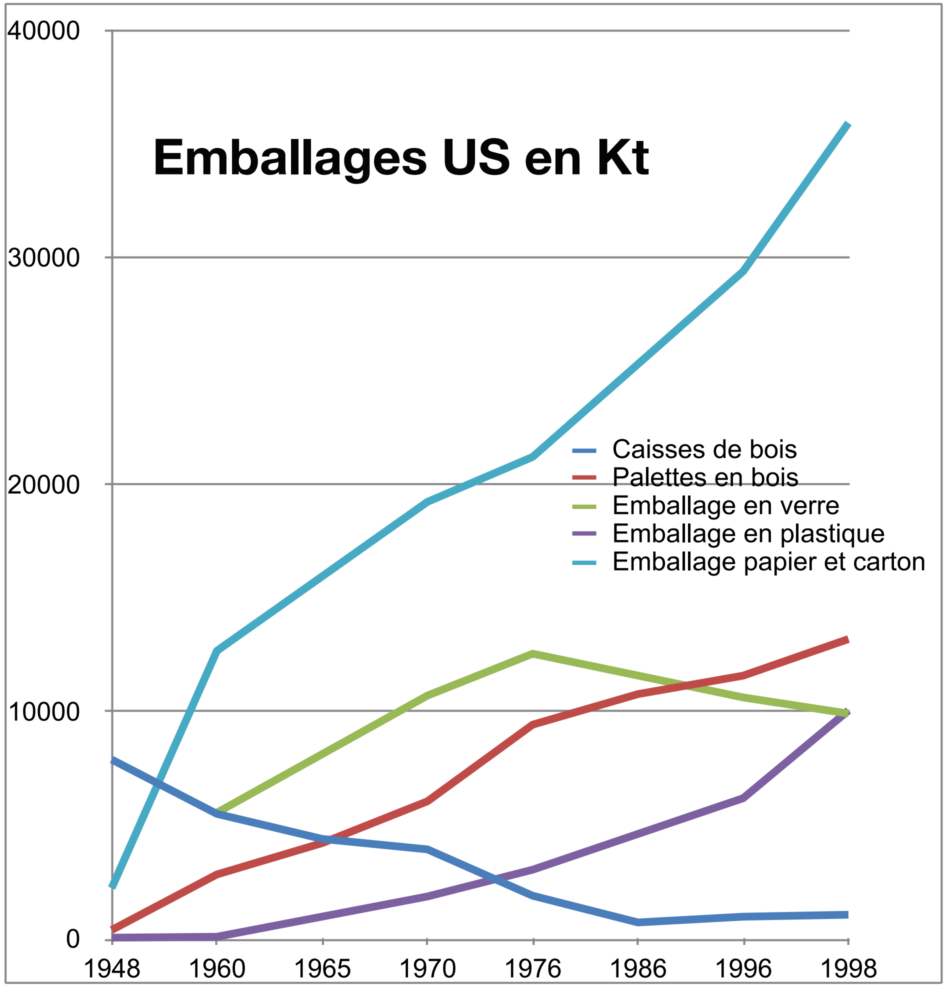



MASSACHUSETTS WHARF COAL CO.
8

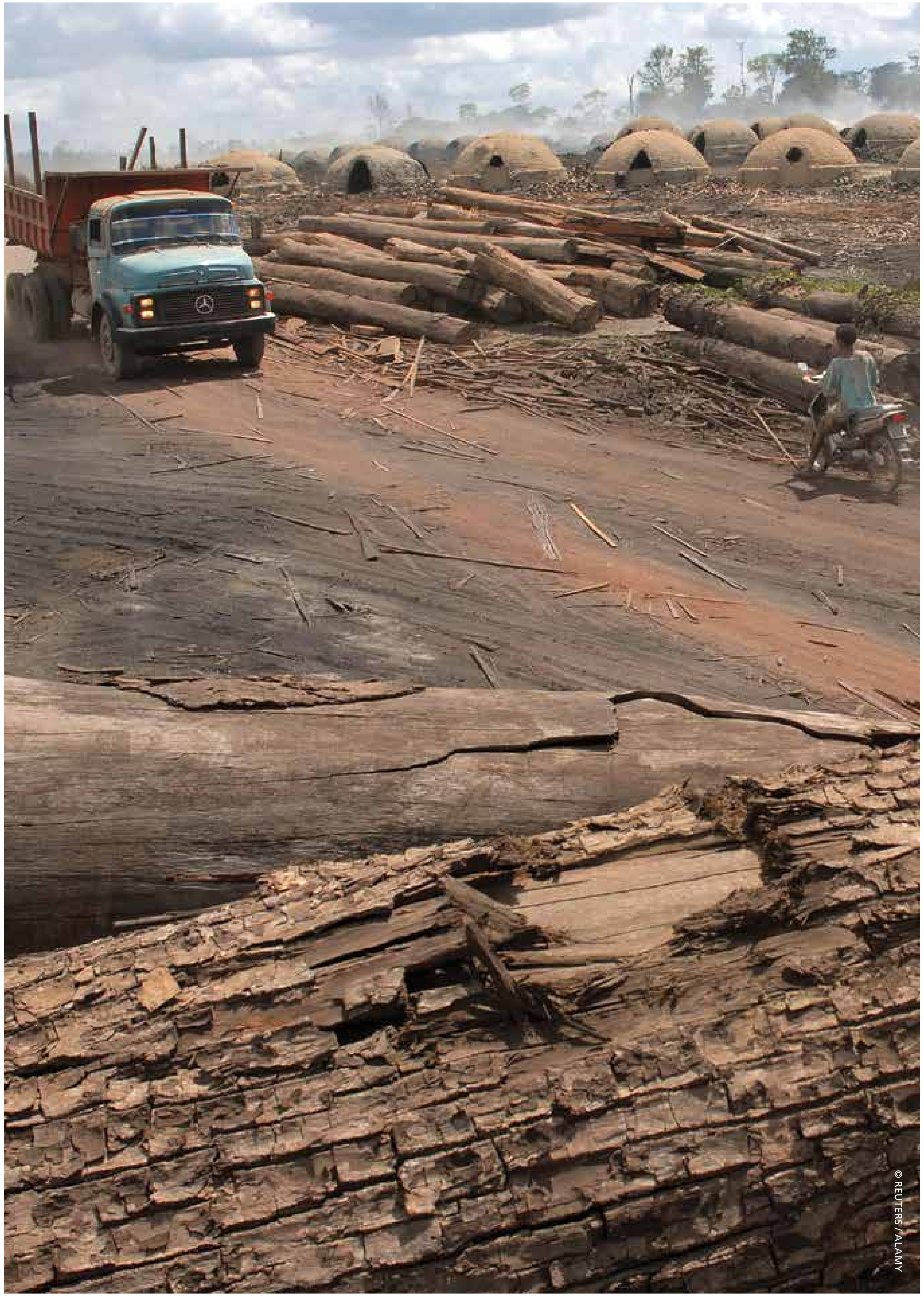

Interstate Cooperage Co., Belhaven, N. C.

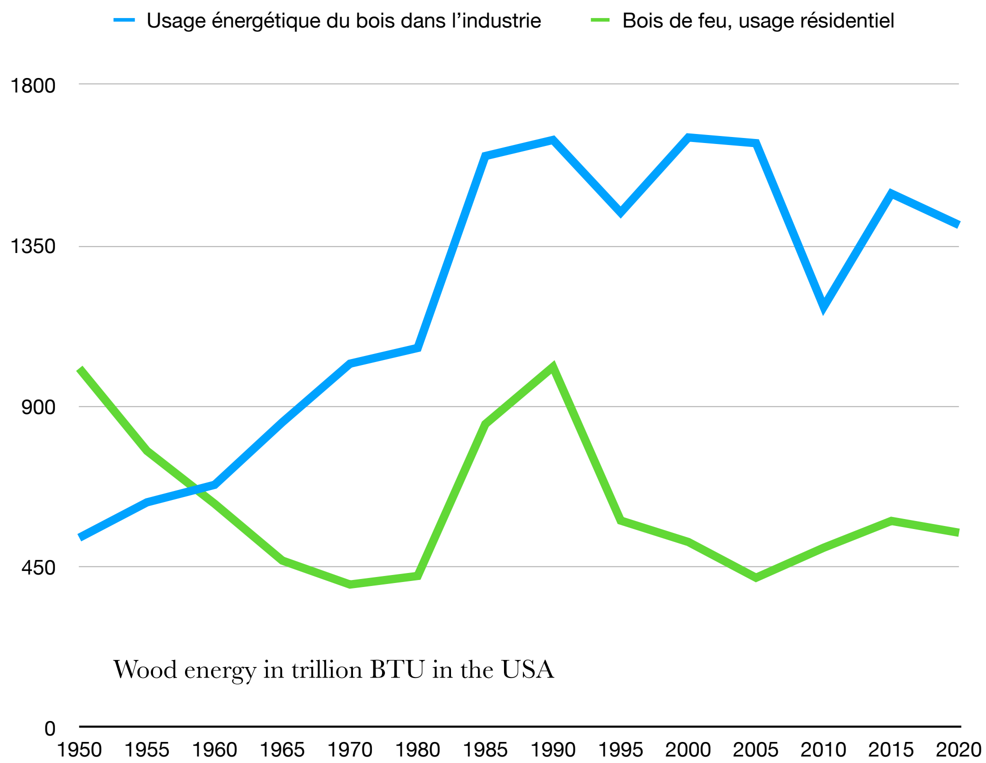
Vallourec Florestal




Emballages US en Kt
40000
30000
20000
10000
0
1948
1960
1965
1970
1976
1986
1996
1998
Caisses de bois
Palettes en bois
Emballage en verre
Emballage en plastique
Emballage papier et carton


#121 (p.109)





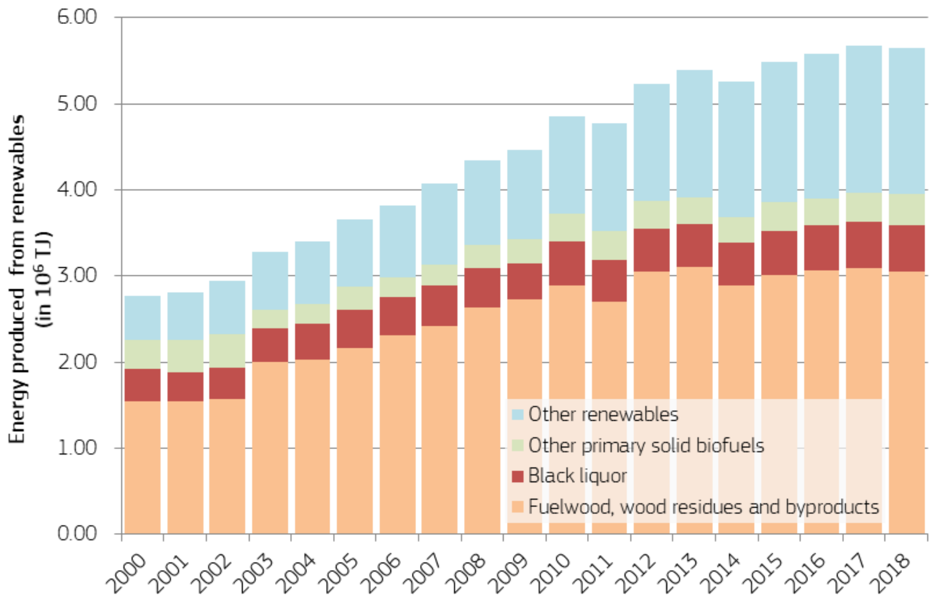


Figure 9. Indigenous production of renewable energy in the EU and share of wood-based energy (source: Eurostat nrg_cb_rw)


JCB
535

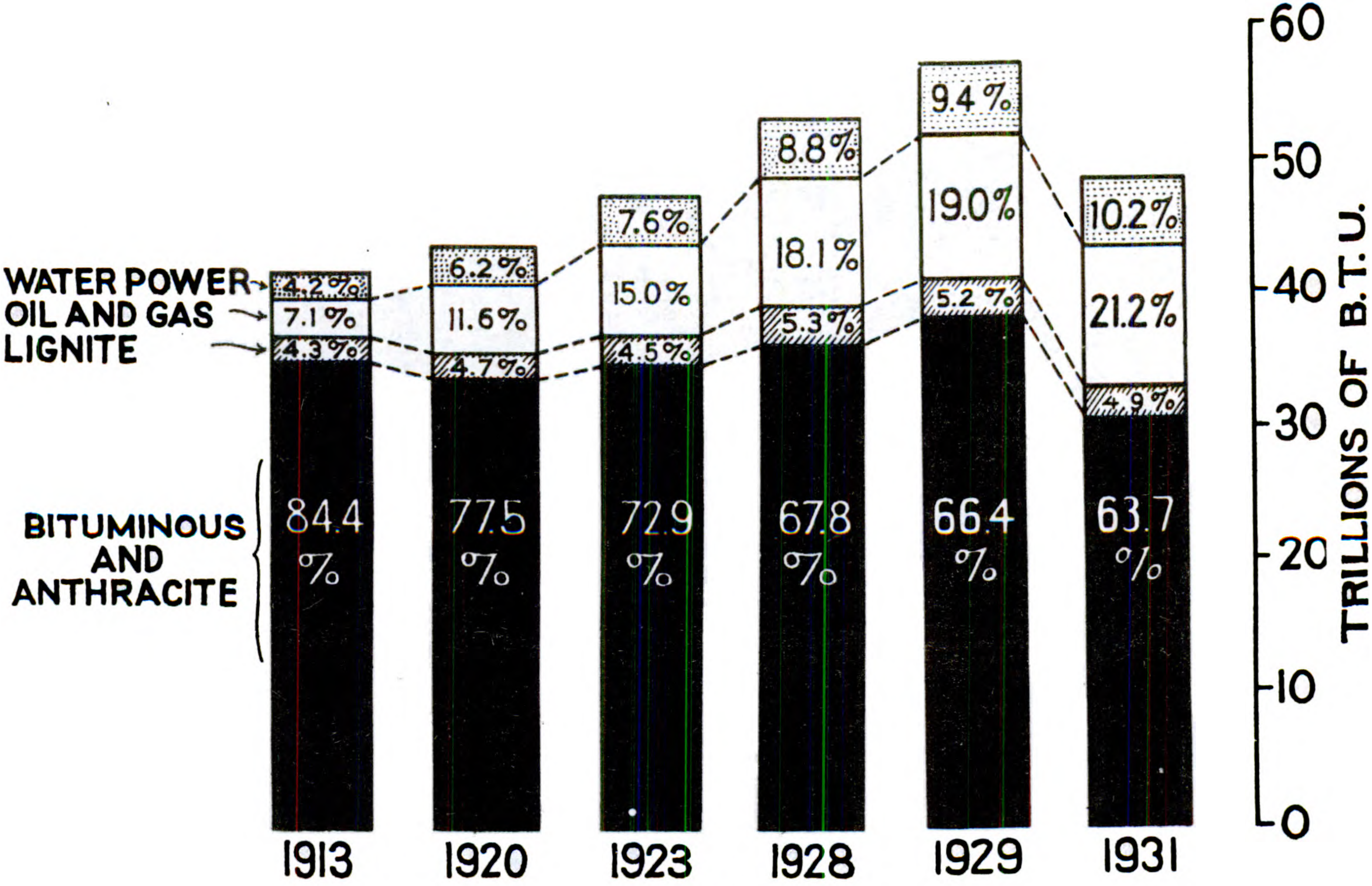


Figure 6.- Trend of the world's consumption of energy, 1913 to 1931

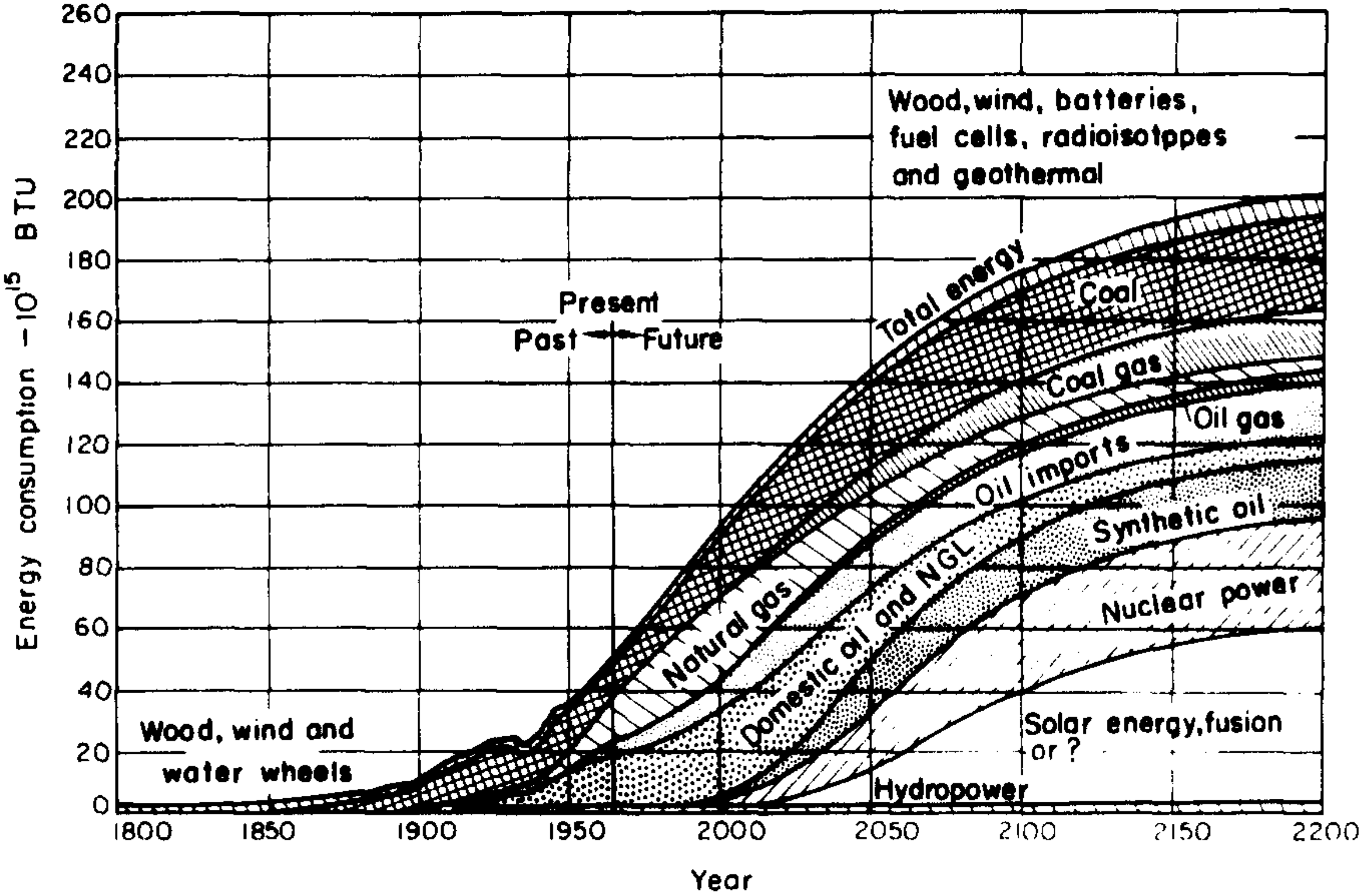


Fig. 1. Energy sources in the United States.

Leon P. Gaucher, « Energy Requirements of the future », *Solar Energy*, 1972, vol. 14, p. 5-10.

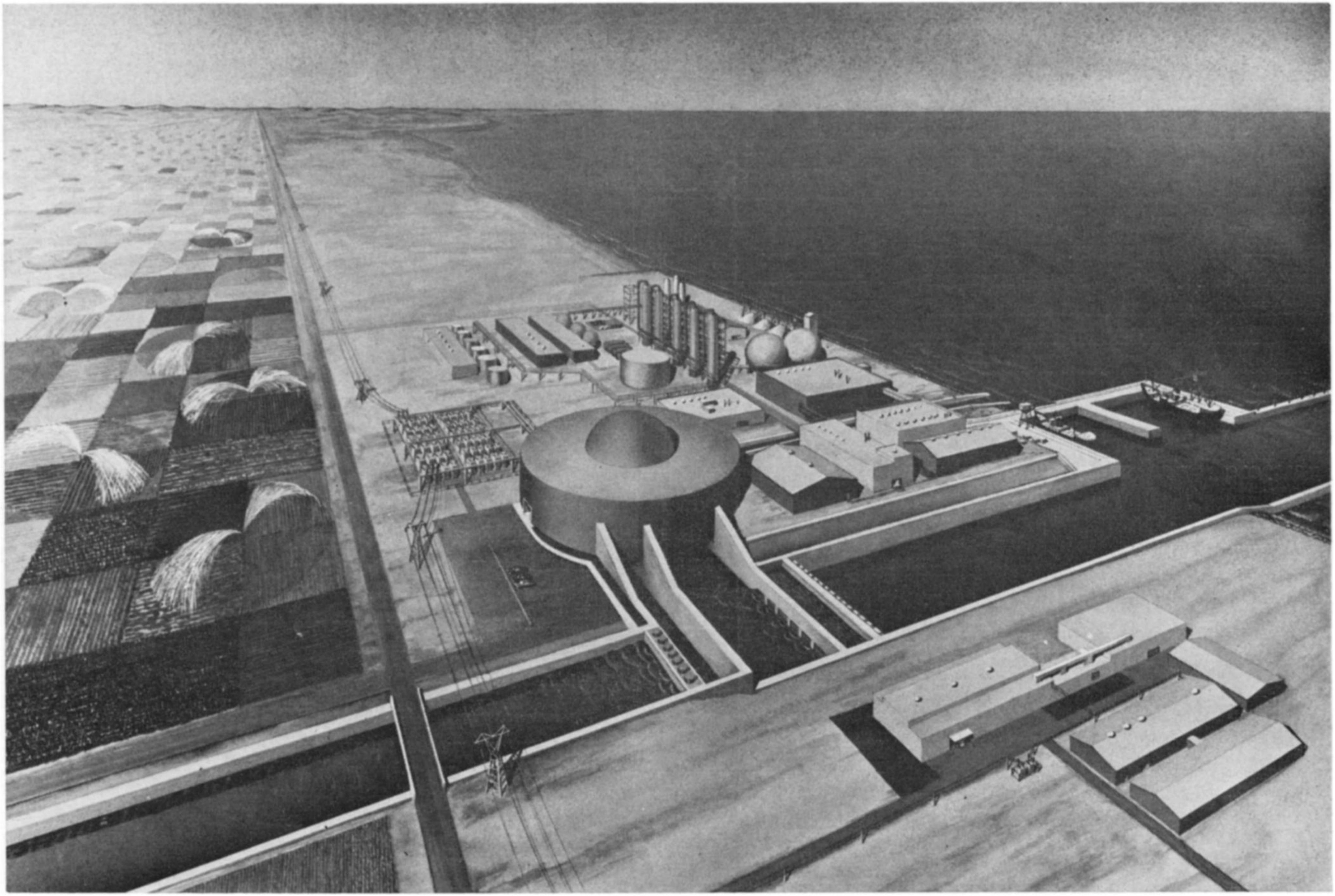
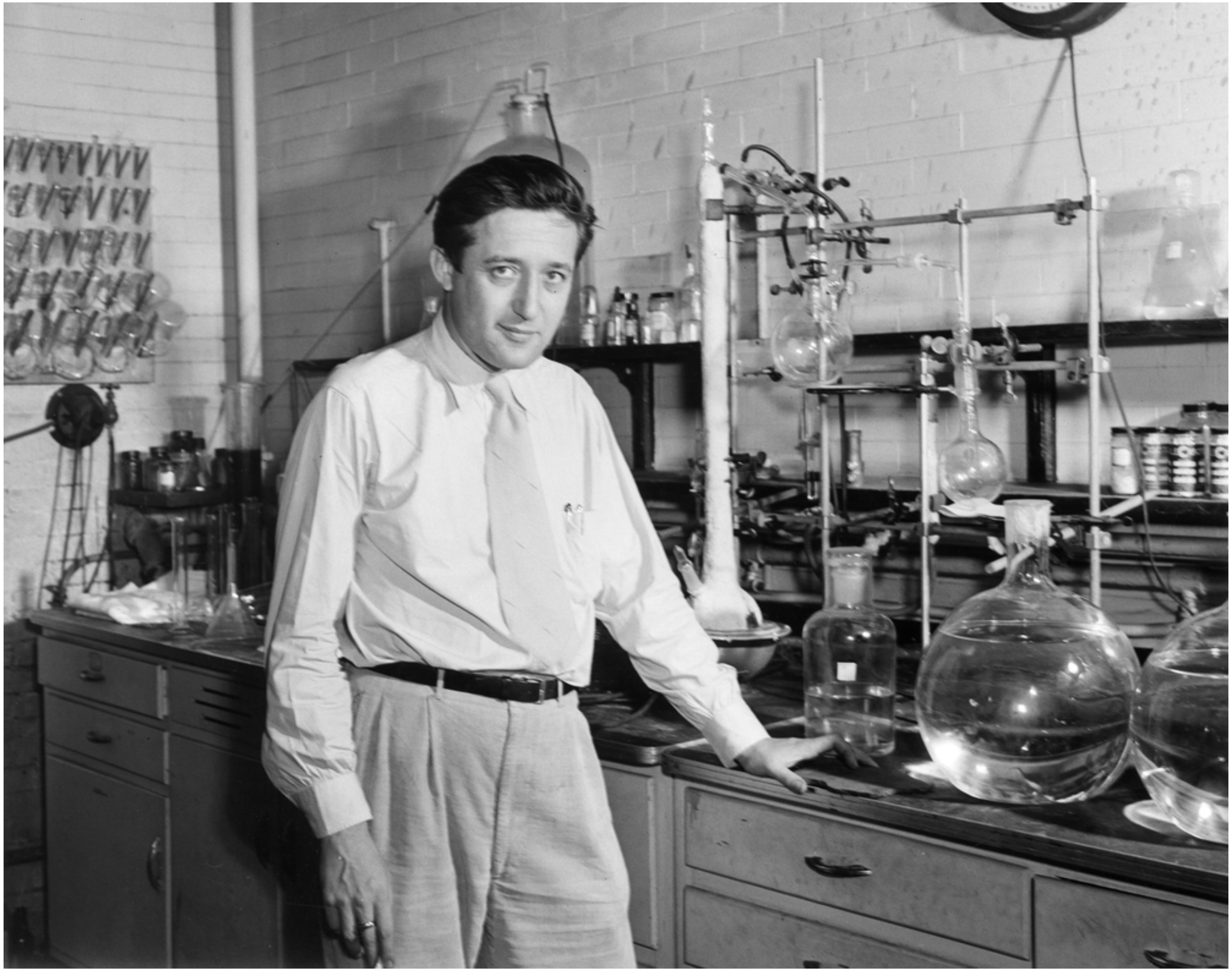


Figure 2. Artist's conception of an agro-industrial complex of the future, in which the energy of the atom is used to transform an arid desert region into productive farms and cities by supplying water, fertilizer, industrial chemicals, metals, etc. The usable portion of the earth's surface could be more than doubled in this way.

Harrison Brown



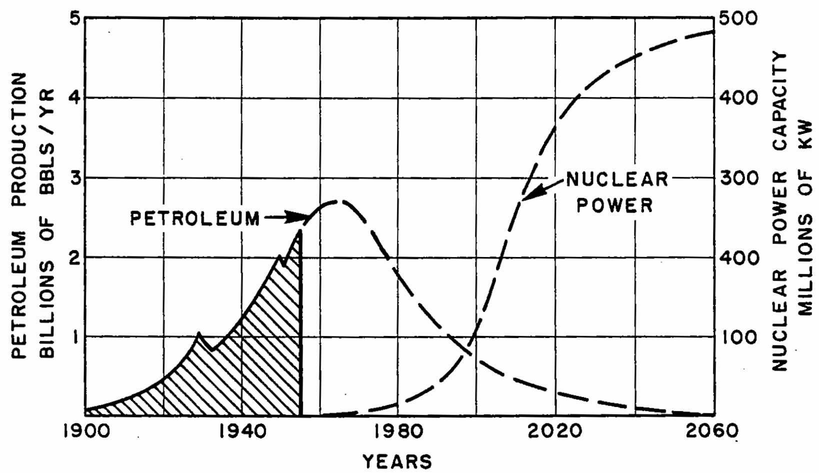
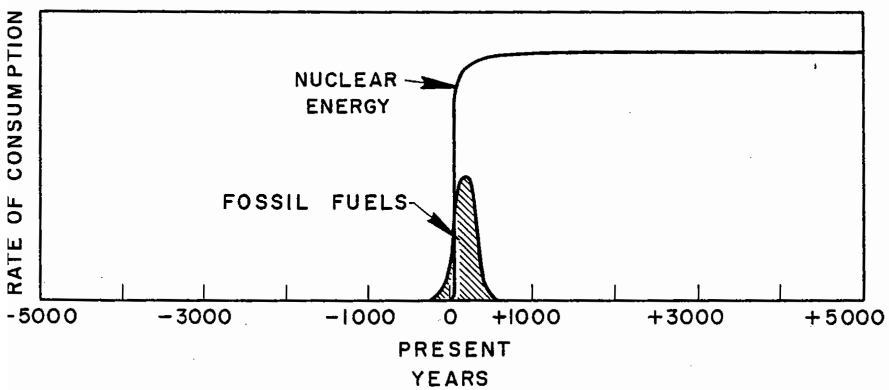


Figure 29 - Concurrent decline of petroleum production and rise of production of nuclear power in the United States. Growth rate of 10 percent per year for nuclear power is assumed; actual rate may be twice this amount.



jure 30 - Relative magnitudes of possible fossil-fuel and nuclear-
ergy consumption seen in time perspective of minus to plus 5000 years.

Marion K. Hubbert, « Nuclear Energy and the Fossil Fuels », Shell Development Company, n°95, 1956.

This vital resource is becoming extinct. General Electric is working on its successor.

Experts say all the economically recoverable coal in the U.S. may disappear in 80 to 150 years. The world's supply in 300 years. And gas and oil before then.

The world must find other fuels. Especially new fuels to generate electricity.

One answer is nuclear power. General Electric has 68 nuclear plants in the works to help meet electric needs for years to come.

For beyond that, GE is working with the government and utilities on a new nuclear power plant. A fast-breeder reactor.

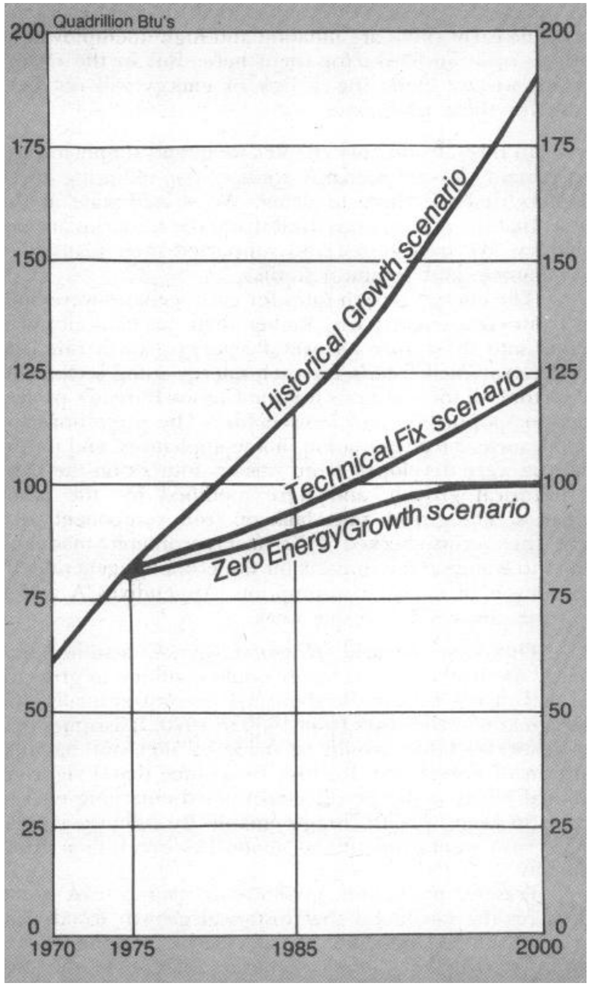
The fast-breeder has already been tested. Not only will it make electricity. It will make fuel . . . more than it uses. So it will postpone the fuel shortage . . . perhaps for thousands of years.

GE is also working on ways to transmit more electricity over present wires. And new underground distribution systems.

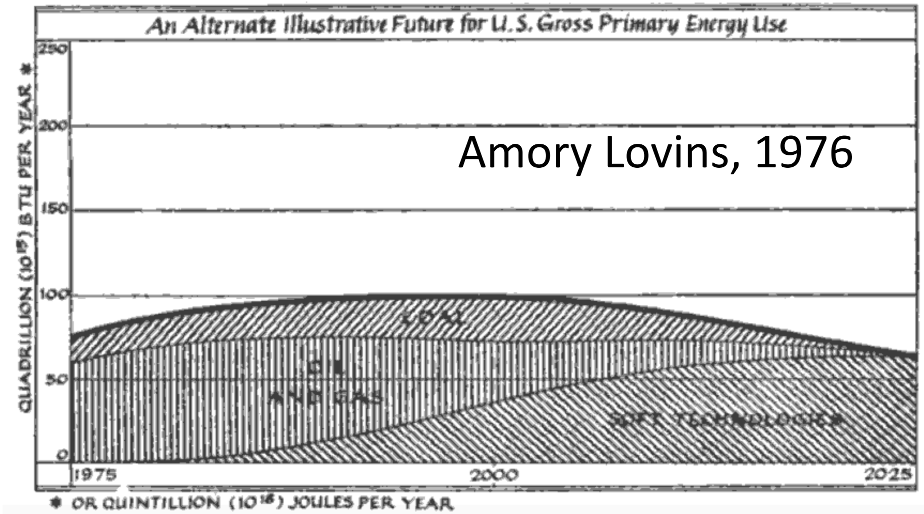
There's no easy way to meet future energy needs. But GE is working to make it easier.

Men helping Man

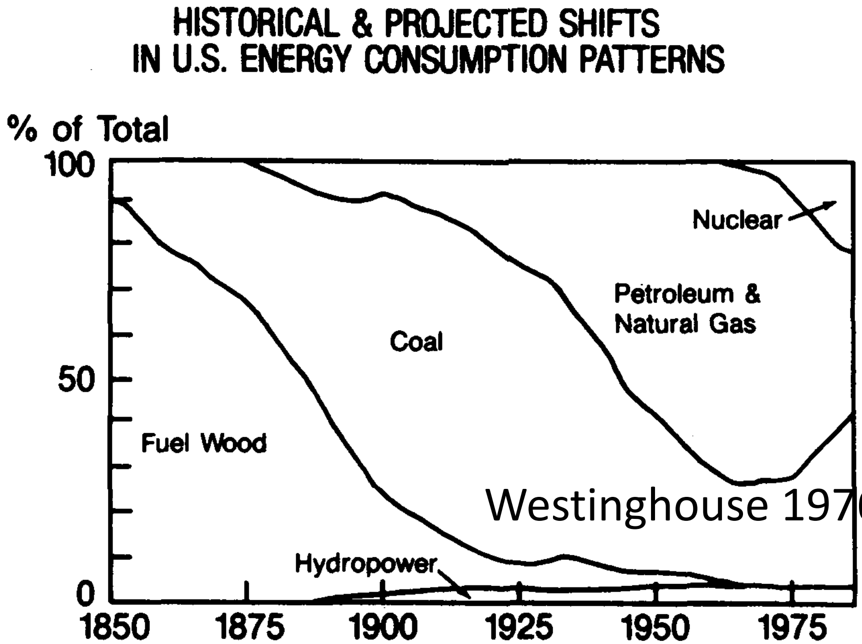
Newsweek 1972



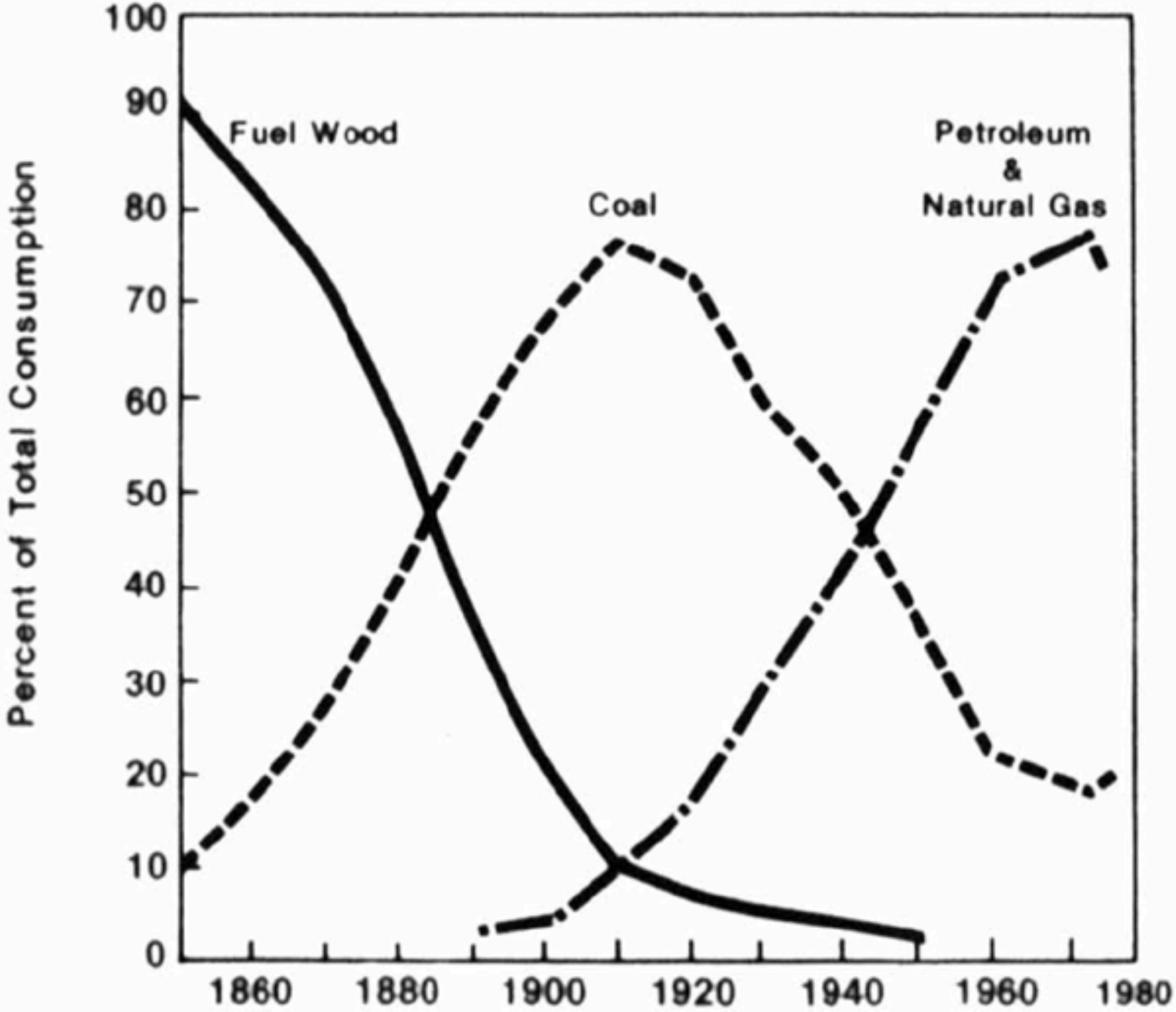
Ford Foundation, A time to choose, 1974



Amory Lovins, 1976

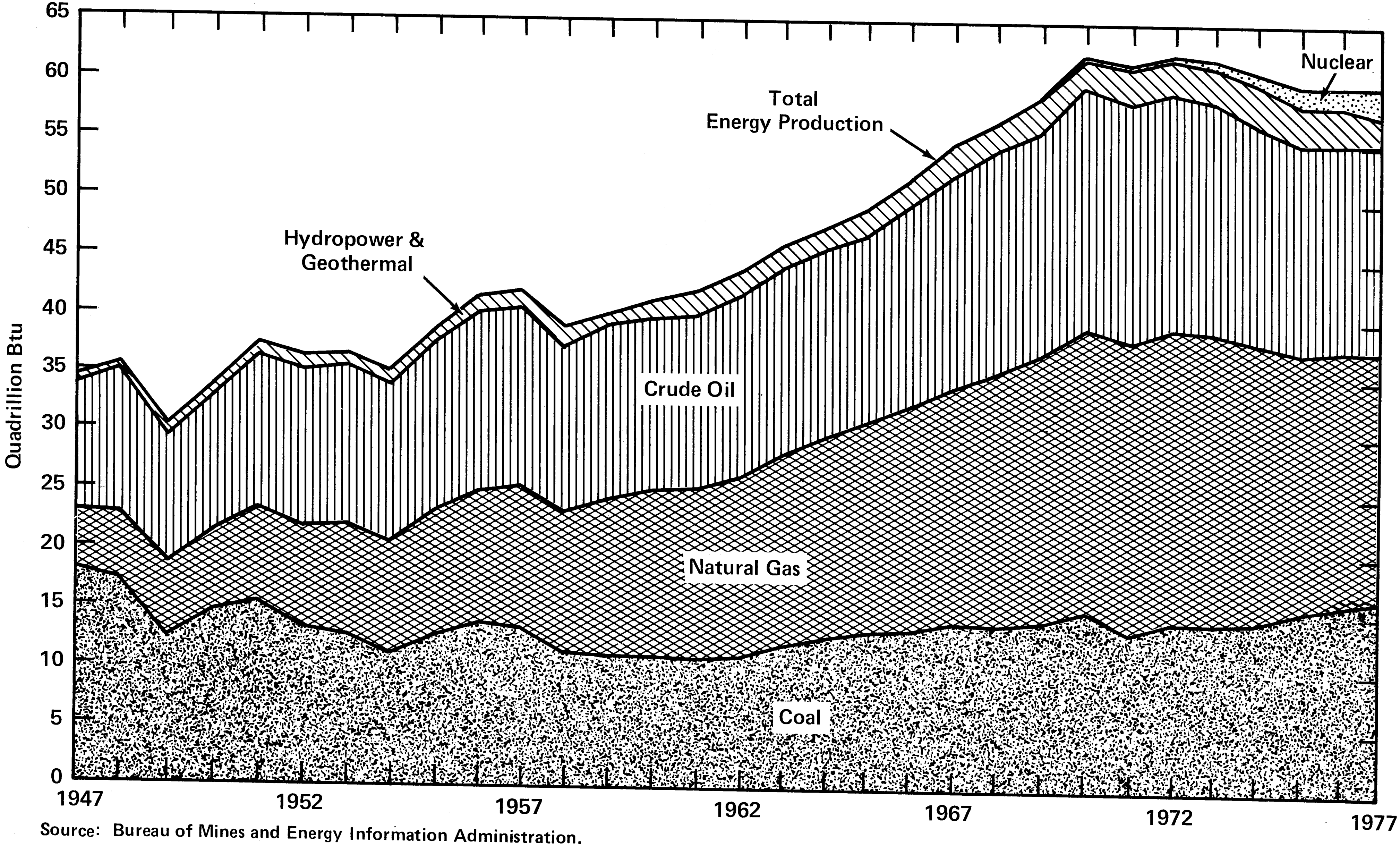


Westinghouse 1976



US *National Energy Plan*,1977

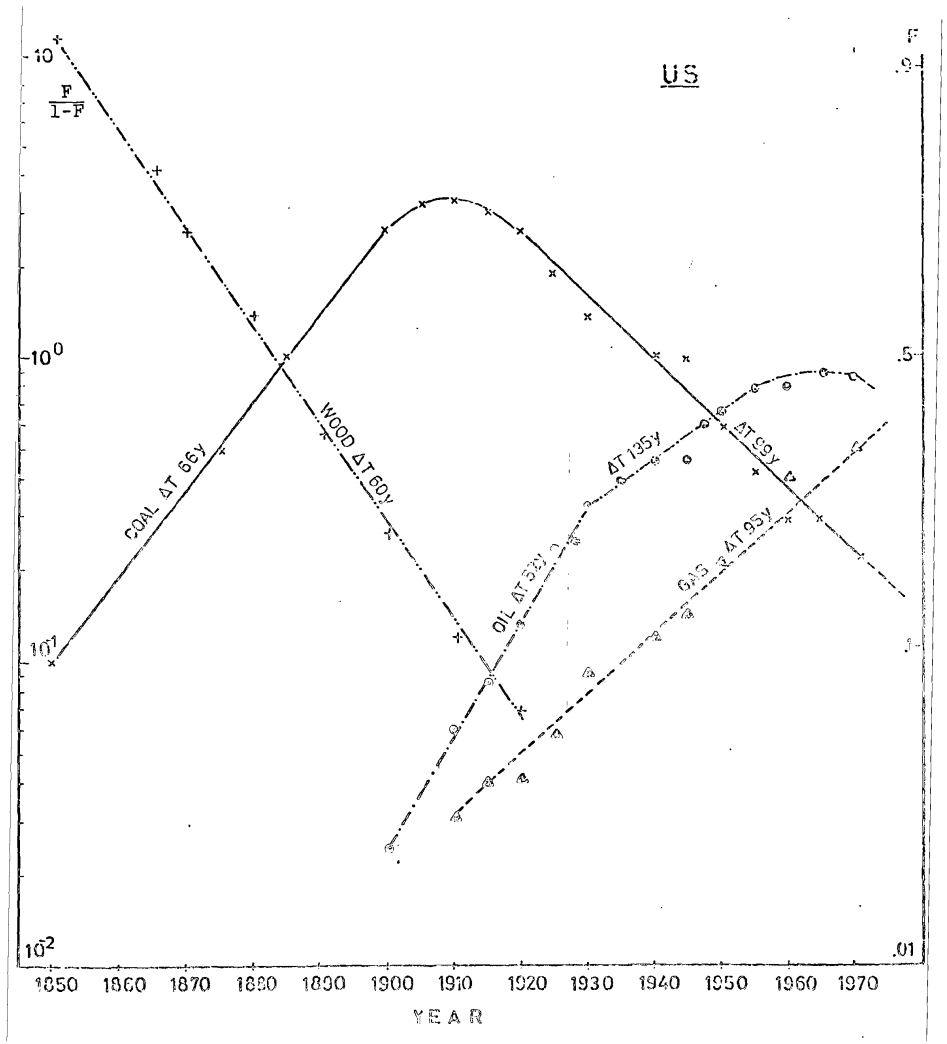
Energy Production by Primary Energy Type



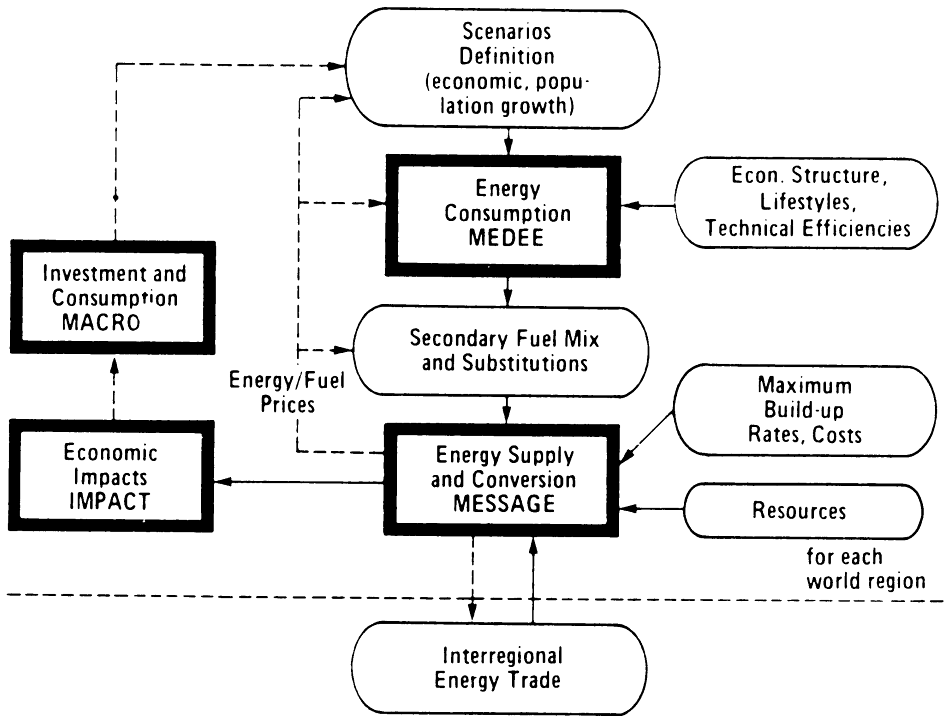
Source: Bureau of Mines and Energy Information Administration.

Energy Information Administration report to the Congress, 1978

Marchetti, IIASA, 1975



Cesare Marchetti, critique des scénarios du IIASA



« Don't forget the system, the system will not forget you! »
Cesare Marchetti 1975

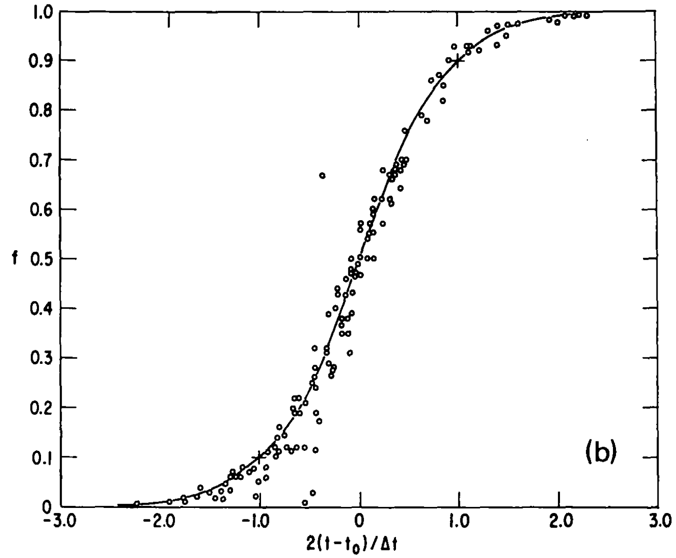
Cesare Marchetti, 1975

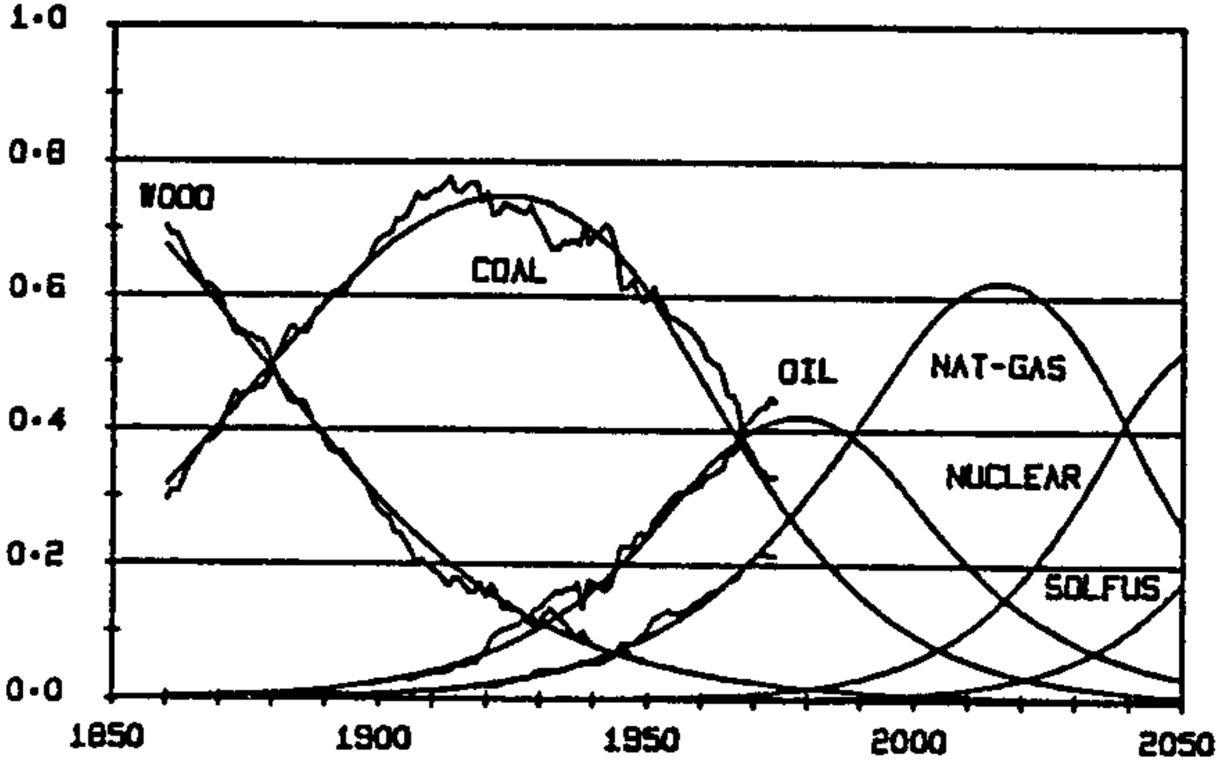
« The whole destiny of an energy source seems to be

completely predetermined in the first childhood

These trends go unscathed through wars,

wild oscillations in energy prices and depressions »





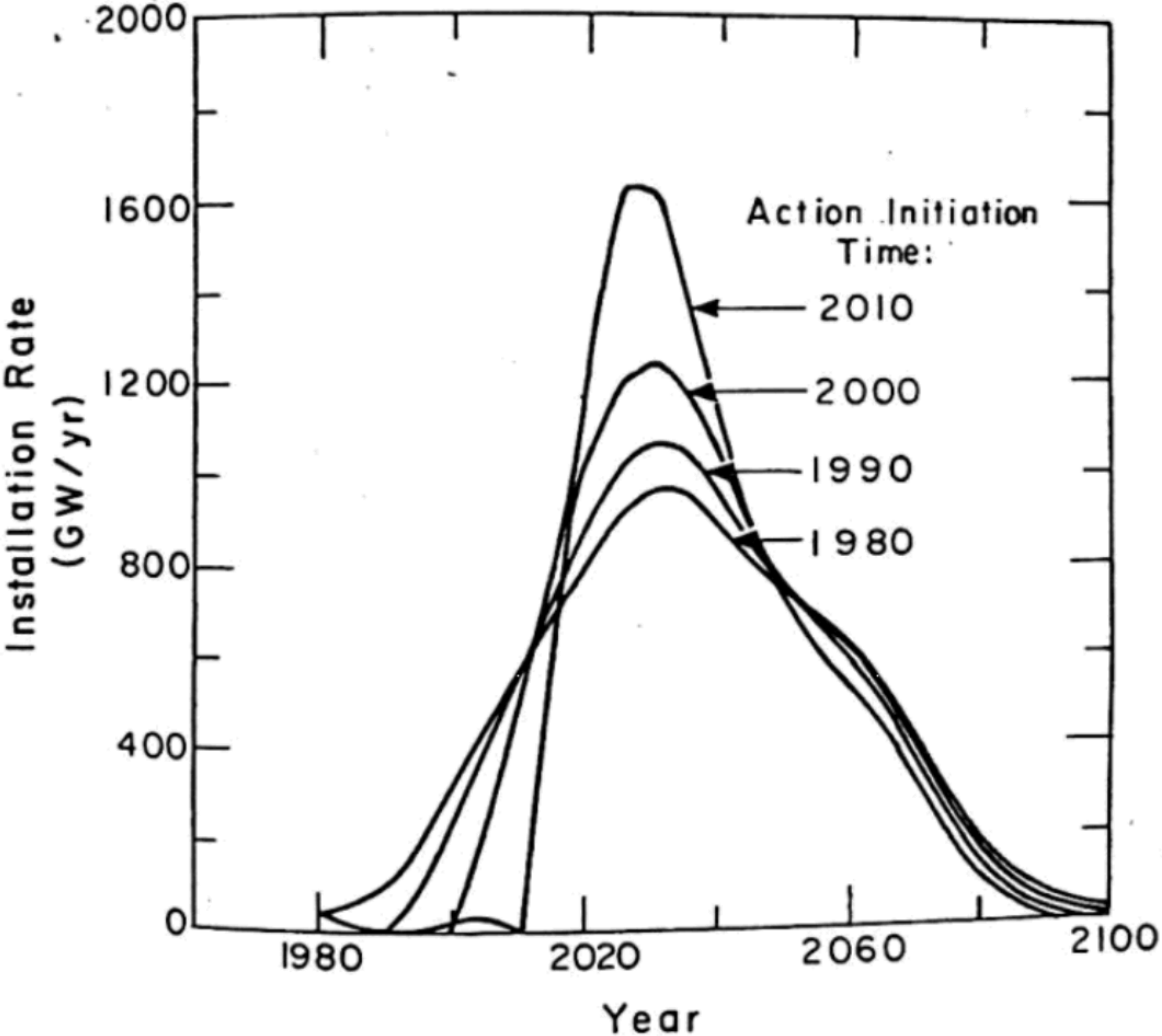
Few people doubt that the world has entered an energy transition away from dependence upon fossil fuels and toward some mix of renewable resources that will not pose problems of CO_2 accumulation. The question is how do we get from here to there while preserving the health of our political, economic, and environmental support systems. What I will do in the remainder

The IIASA study concludes that to make a successful transition from fossil fuels to an energy system based on renewable resources, the world economy must expand its productive powers. It must expand in all dimensions, but, most importantly, in the new knowledge and human skill that enlarge the technological base. For such knowledge and skill, more than brute capital, is what enables societies in this age to use the same or even fewer resources to produce more.

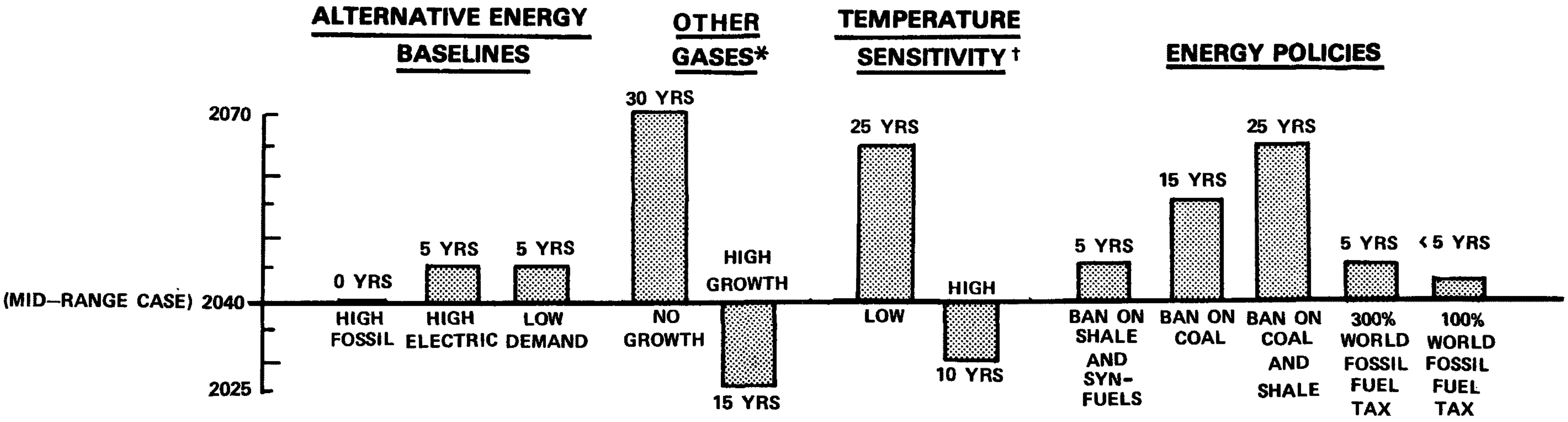
The IIASA strategy for inventing that future resembles the one I have suggested: a strategy first, of gradual transition from clean, high quality resources--natural gas and oil--to dirtier unconventional fossil resources. The study also takes note of the CO_2 issue, recommending that society incorporate sufficient non-fossil options in the energy supply system so as to allow expansion of that base, if necessary, as the effects of carbon dioxide become better quantifiable through further research.

Edward David
« Inventing the future,
Energy and the CO2 problem »
Exxon, 1982.

fuels. Fortunately, these conditions give science and engineering a lot of room to maneuver. It appears we still have time to generate the wealth and knowledge we will need to invent the transition to a stable energy system.



2000
1600
1200
800
400
0
Installation Rate (GW/yr)
Action Initiation Time:
2010
2000
1990
1980
1980
2020
2060
2100
Year



Changement de date d'un réchauffement de +2°C. Stephen Siedel et Dale Kayes, « Can De Delay A Greenhouse Warming? », *Environmental Protection Agency*, 1983, p. vi.